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~~PREScription MANAGEMENT SYSTEM~~

~~ABSTRACT OF THE DISCLOSURE~~

~~TECHNICAL FIELD~~

1 This invention relates to professional data management  
2 systems useful in the production of product specification  
3 documents such as prescriptions, service or parts orders,  
4 insurance contracts and the like that require detailed  
5 product and history information from multiple extensive  
6 information sources, especially remote heterogenous sources.  
7 More particularly, the invention relates to systems that  
8 assist professionals perform their everyday work in  
9 specifying customized technical products. A particularly  
10 preferred embodiment relates to a computer-implemented  
11 prescription management system to assist physicians in  
12 prescribing and reviewing drugs.

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BACKGROUND

An important professional activity undertaken by most physicians during the course of their day is the prescribing of drugs. Many physicians prescribe a great number of drugs every day. Studies show that over two thirds of all doctor-patient encounters were completed with the writing of a prescription. In 1993 typical prescribers were prescribing in excess of two hundred thousand dollars-worth of drugs annually. While most physicians exercise the utmost of professional skill and caution in prescribing, there are inherent difficulties and uncertainties in the process. Most physicians will probably agree that they do not have access to adequate, reliable drug information and relevant patient information at the time and point of prescription. In particular, information regarding relevant new drugs, comparative efficacy, and importantly, relative costs, may not be readily and conveniently available to a physician creating a new prescription, as well as relevant patient information such as current conditions being treated, current treatments, and preferred medications for conditions, pursuant to requirements of the patient's drug formulary.

Nevertheless, while accessing it is impractical for the typical practitioner, such information is available to any physician willing to take the time and make the effort to

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1 obtain it.

2

3 In contrast, integrated patient-specific information which  
4 is directly relevant to treatment management for the subject  
5 patient is frequently both unavailable to, and unobtainable  
6 by, a prescribing physician unless that physician's  
7 institution or organization has been exhaustively  
8 responsible for the subject patient's prior care and  
9 maintains sophisticated computerized records. Information  
10 as to allergies, current prescriptions and currently active  
11 conditions is clearly desirable or essential for intelligent  
12 prescribing. In 1994, few prescribing sessions are  
13 conducted with the benefits of integrated patient-specific  
14 information and fewer still have the benefit of specific  
15 drug formulary recommendations on the subject patient.

16  
17 ~~Typically, drug formularies comprise lists of preferred~~  
18 ~~drugs whose costs will be borne by a drugs benefit house.~~ <sup>B2</sup>

19 Drug formulary information is usually determinative of the  
20 cost-effectiveness of a prescription. Unwitting failure by  
21 a prescriber to follow formulary guidelines can impose  
22 unnecessary or unexpected cost burdens on the patient, or  
23 their benefits provider, and lead to poor patient compliance  
24 and aggravating and time-consuming disputes. The cost in  
25 dollars of non-compliance with drug formulary guidelines to  
26 benefit-providing corporations, insurers, health maintenance

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1 organizations and government providers, for example MEDICAID  
2 and MEDICARE, can be enormous. The cost of poor patient  
3 compliance may ultimately increase the total cost of care by  
4 generating a more serious, expensive adverse health outcome  
5 ( emergency room visit, or hospital admission or death).  
6

7 A difficulty in making integrated patient-specific  
8 information readily available to prescribing professionals  
9 is that the needed information components are not  
10 centralized but are widely distributed geographically and  
11 even when their geographic or electronic locations are  
12 known, are hard to access because of proprietary and  
13 liability and patient-confidentiality concerns and because  
14 of system, file or protocol incompatibilities.  
15

16 Even in the computer-abundant United States, in the mid-  
17 90's, prescription writing is generally a manual process.  
18 After consulting with a patient to determine their problems  
19 and diagnosing, or attempting to diagnose their condition or  
20 disease, a physician selects a drug and a dosage and an  
21 amount to prescribe based upon their own personal knowledge  
22 and experience, if necessary using available reference  
23 materials which may or may not include promotional materials  
24 from drug manufacturers. A prescription is then written up  
25 under the physician's signature and bears a patient  
26 identification, a drug name, dosage amount and timing,

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1    refillability information and the physician's signature, the  
2    date, possibly an advisory regarding contraindications, and  
3    little other information. While a prescription may be  
4    typed, keyed or otherwise "generated" on a computer most  
5    prescriptions are still manually written.

6  
7    Prescribing activity should be a good field for  
8    computerization, but one difficulty is the lack of apparent  
9    benefits to many physicians. Paper prescription pads are  
10   small and easily carried around by a physician. Manually  
11   writing a prescription will often be quicker and easier than  
12   using a computer, however good the system. The benefits of  
13   automated information systems often come not from greater  
14   data entry efficiency, but from the increased efficiency of  
15   the entire process, from the value of the transaction  
16   records generated and also from the control of the  
17   transaction entry process which may ensue. Physicians who  
18   are not computer-literate or who are even "computer-phobic"  
19   will require a most compelling reason to adopt a  
20   computerized prescription management system.

21  
22   To be fully effective, a prescription management system must  
23   be readily usable by a wide range of physicians, preferably  
24   for all their prescribing activity must provide compelling  
25   value to patient care and increase overall treatment  
26   management efficiency. Providing an attractive computer-

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1 based system to physicians is fraught with unexpected  
2 difficulties.

3  
4 Physicians and other health care professionals, especially  
5 those with prescribing authority, are representative of  
6 certain groups of professionals whose unique characteristics  
7 raise obstacles to the computerization of their day-to-day  
8 professional activities. Desirably, a computerized  
9 professional management system should be capable of flexible  
10 integration into their personalized and varied work flows.

11  
12 Contrary to many perceptions and assumptions in conventional  
13 data-management systems intended for use by physicians,  
14 clinical physicians are not deskbound workers and do not  
15 usually have continuous access to a personal desktop  
16 computer during the course of their normal daily routine.  
17 To the contrary most physicians are ambulatory or even  
18 highly mobile, moving from room to room, from office to  
19 office, from hospital to hospital and to and from their car  
20 and home. While some physicians may spend the majority of  
21 their health care patient encounter activities at or near a  
22 desktop in their own office, such physicians are probably  
23 the exception. In clinics and hospitals physicians are  
24 often continually on the move between examination rooms,  
25 reception areas, administrative centers, hospital wards,  
26 specialist facilities such as radiology rooms and so on and

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1 so forth. In addition many physicians have more than one  
2 practice or more than one professional activity which takes  
3 them between an office or clinic and a hospital or other  
4 facility on a regular basis. Accordingly, it is a  
5 significant technical challenge to provide such mobile  
6 physicians with access to a computer-implemented management  
7 system that is readily available at the point of care.  
8

9 Portable computers are a possible solution to the access  
10 problem now that powerful and compact notebook computers are  
11 widely available. Although currently available portable  
12 computers offer some advantages particularly to physicians  
13 moving between one work place and another, they also suffer  
14 certain drawbacks. One drawback is that external  
15 communication is difficult being commonly effected by moving  
16 diskettes, a valuable but limited method, or by modem  
17 connection to a telephone line which inconveniently requires  
18 plugging into a wall jack. Though possibly adequate for a  
19 physician having multiple offices, neither the communication  
20 means nor the portability of such systems is satisfactory  
21 for a ward physician moving from patient bed to patient  
22 bed. The weights and form factors of traditional portable  
23 computers are severe impediments to their assimilation into  
24 many clinical physicians' daily lives as dependable  
25 assistants to their professional work.  
26

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1 More recently, small handheld or palm computers known as  
2 personal digital assistants or personal information  
3 communicators have become available. An example is the  
4 Apple NEWTON (trademark). As of summer 1994, these are  
5 rather rudimentary devices as compared with desktop or full-  
6 powered portable systems, having modest permanent and RAM  
7 storage capacities and limited processing and communications  
8 abilities. Attractive to busy mobile professionals for  
9 their small size, such handheld computers can also embody  
10 highly desirable radio wave or infrared wireless  
11 communications abilities enabling them to exchange data with  
12 host systems without the cost or inconvenience of hard  
13 wiring.

14  
15 Such portable hand held radio communicating computing  
16 devices are attractive for computerizing mobile  
17 professionals such as physicians, but their processing and  
18 storage limitations represent a real problem in providing a  
19 sophisticated, capable and attractive system for physicians.

20  
21 A broad objective of this invention is to provide a  
22 prescription management system that can be used by  
23 physicians on such mobile computing devices.

24  
25 Simply delivering a system on a convenient portable computer  
26 will not be enough to assure its regular use by a majority

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An experienced professional practicing their specialty for example a pediatrician treating infants knows from experience exactly what to prescribe, in many instances. They will have neither the time nor the patience to work their way through conventional software selection and data

1 entry procedures. Accordingly, a further object of this  
2 invention is to provide a prescription management system  
3 which personalizes itself to the prescribing patterns of  
4 experienced users.

5  
6 **SUMMARY OF THE INVENTION**

7 This invention solves a problem. It solves the problem of  
8 providing a computerized, prescription management system  
9 that an average prescribing physician can use and will want  
10 to use and which makes possible significant improvements in  
11 the quality of prescriptions written. In preferred  
12 embodiments, the invention also solves the problem of  
13 significantly reducing prescription costs to patients and to  
14 their drugs benefit management company or government agency.  
15 The invention solves these problems for physicians by  
16 providing a prescription management system for electronic  
17 prescription creation by a prescriber at a point of patient  
18 care, said prescription being usable by a pharmacist to  
19 dispense drugs, said prescription management system  
20 comprising:

21 a) electronic posting means to select and capture in said  
22 prescription:

- 23 i) a patient identifier;  
24 ii) a prescribed drug;  
25 iii) a dosage for said prescribed drug; and

26 b) a patient-condition treatment specification procedure;

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1 whereby in creating said prescription said prescriber  
2 specifies a patient condition for treatment by said  
3 prescribed drug.

4  
5 More generally, the invention provides a computer-based  
6 professional product specification system for use by other  
7 professionals, in addition to physicians<sup>and</sup>, which can deliver  
8 substantial benefits to mobile users ~~who may be computer~~  
9 ~~inexperienced~~

10  
11 By associating a patient condition or problem with each drug  
12 prescribed, a treatment objective is both expressed and  
13 recorded, <sup>and the</sup> ~~physician's intent~~ <sup>is captured</sup> ~~and deliver for physicians~~  
14 ~~the problem is solved by providing a user friendly~~ <sup>The invention provides a user-friendly</sup>  
15 prescription management system <sup>which requires</sup> ~~requiring~~ minimal data entry  
16 <sup>many</sup> ~~enabling~~ prescriptions to be created with an overall

17 efficiency unobtainable by ~~any~~ known automated systems and  
18 which can helpfully supplement the skills of the best of  
19 practitioners.

20  
21 Pursuant to one preferred embodiment of the invention, the  
22 drugs in the drug list are classified according to a patient  
23 condition for which the drugs are effective and the onscreen  
24 drug selection procedure lists multiple drugs for treating  
25 each patient problem. In an alternative embodiment, the  
26 user makes a drug selection by generic or brand name or some



1 other drug identifier, and the system supplies, suggests or  
2 requires, entry of an appropriate treatment condition so  
3 that the patient record is completed with the condition or  
4 conditions for which the selected drug is prescribed.

5  
6 The invention also provides a user-adaptive prescription  
7 management system for electronic prescription creation by a  
8 prescriber at a point of patient care, said prescription  
9 being usable by a pharmacist to dispense drugs, said  
10 prescription management system comprising:

11 a) electronic posting means to select and capture in said  
12 prescription:

- 13 i) a patient identifier;  
14 ii) a prescribed drug;  
15 iii) a dosage for said prescribed drug;

16 b) a patient-condition treatment specification procedure  
17 whereby in creating said prescription said prescriber  
18 specifies a patient condition for treatment by said  
19 prescribed drug;

20 c) an onscreen drug selection procedure having a patient  
21 condition list specifying multiple possible patient  
22 conditions, having a drug list specifying multiple  
23 possible prescribable drugs and having drug  
24 specification means to select and post a desired drug  
25 to said prescription; and

26 d) tracking means to track preferred data usage by a user

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1 and to adapt data displays to favor such preferred  
2 usage, whereby the system learns and adapts to a user's  
3 habits;

4 wherein drugs in said drug list are classified according to  
5 a patient condition for which said drugs have efficacy and  
6 said onscreen drug selection procedure lists multiple drugs  
7 for treating each said patient problem.

8  
9 Drug lists or individual drug selections or suggestions may  
10 be presented to prescriber-users in any of a variety of ways  
11 for example by frequency of prescription for a selected  
12 condition, based upon either the user's historical  
13 prescription activity or a wider base of historical  
14 prescribing activity, which could be nationally or  
15 regionally defined or derived from a drugs benefit house,  
16 health maintenance organization, hospital or other  
17 appropriate institution.

18  
19 System suggestions for condition-related drug selection may  
20 be further refined into categories such as relative cost,  
21 generic or brand name and so on. Where many drugs are  
22 available for treating a patient's active condition, one  
23 particularly useful presentation is by multiple lines of  
24 therapeutic preference according to drug formulary  
25 guidelines. Thus, within the patient's particular formulary  
26 there may be suggested first, second and third lines of

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1 therapy. Different suggestions may be made for different  
2 patients according to the preferences of the patient's  
3 particular drugs benefit management company.

4  
5 Preferably the system includes a comprehensive database of  
6 approved drugs classified by conditions for which they are  
7 known to have therapeutic effect and this database need not  
8 be maintained in the users station but should be accessible  
9 in real time to the user. Many valuable professional  
10 benefits are obtained by delivering a selective listing of  
11 drugs by condition to a physician. For example in treating  
12 a particular chronic condition such as gastro-intestinal  
13 disease, a physician may find that common medicaments such  
14 as antacids are ineffective, that a particular brand name  
15 drug such as TAGAMET (trademark) has, with prolonged use,  
16 undesired side effects so that the physician may at this  
17 point be interested in gaining information about alternative  
18 drugs with which they are less familiar. If the physician  
19 does not have the information at their finger tips, this  
20 could be a time consuming process in their office reviewing  
21 files and other archival information systems they have.  
22 Alternatively on-line electronic services may be used but  
23 this can also be a time consuming process. By offering a  
24 comprehensive selection of drugs known to be effective for a  
25 particular condition, this problem is easily solved for the  
26 physician. The preferred embodiments include back-up

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1 prescribing information on each drug, along with details of  
2 literature references supporting its manufacturer's  
3 therapeutic claims or with means enabling the physician  
4 promptly to obtain such references.

5  
6 The invention is not limited to providing a prescription  
7 management system. It can provide, in the medical field  
8 alone, systems for clinical laboratory management, for  
9 medical record management for radiology management and the  
10 like. In addition the invention can provide novel  
11 professional data management systems that can create new  
12 products and yield comparable benefits in other professional  
13 spheres where professionals are responsible for specifying  
14 more or less complex technical products to solve client or  
15 customer problems.

16  
17 In this wider aspect the invention provides a professional  
18 product specification system for electronically creating a  
19 technical specification usable by a professional to specify  
20 technical products said product specification system  
21 comprising:

22 a) electronic posting means to select and capture in said  
23 technical specification:

- 24 i) a customer identifier;  
25 ii) a specified product; and

26 b) an onscreen product selection procedure having a

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1 product benefit list specifying multiple possible  
2 customer benefits having a product list specifying  
3 multiple possible specifiable products and having  
4 product specification means to select and post a  
5 desired product to said specification;  
6 wherein products in said product list are classified  
7 according to a customer benefit which said products can  
8 provide and said onscreen product selection procedure lists  
9 multiple products for providing each said customer benefit.

11 BRIEF DESCRIPTION OF THE DRAWINGS

12 By way of example, some preferred embodiments of the  
13 invention are described in detail below with reference to  
14 the accompanying drawings in which:-

15  
16 **Figure 1** shows a system entry screen of a prescription  
17 ~~management~~ <sup>creation</sup> system embodiment of the invention  
18 which system incorporates the screens of  
19 Figures 2-11;

20 **Figure 2** is a patient selection screen;

21 **Figure 3** shows a prescription creation screen;

22 **Figure 4** is a condition list selection screen;

23 **Figure 5** is a condition selection screen;

24 **Figure 6** is a drug selection screen, condition  
25 specified;

26 **Figure 7** is a nonformulary drug selection screen;

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Figure 8 is an alternative condition-specification and drug selection screen;

Figure 9 is an alternative direct drug specification screen;

Figure 10 is a condition selection screen, drug specified;

Figure 11 is a drug selection evaluation screen;

Figure 12 is a single prescription history screen.

Figure 13 is a patient problem history information screen; and

Figure 14 is a manually updatable problem list maintenance screen;

Figure 15 illustrates a scheduled dosage drug package;

~~and~~

Figure 16 is a schematic diagram of one way of connecting users of the prescription management system of Figures 1-14 with remote source databases across network to provide data and processing resources needed during operation of the prescription management system and useful inter alia for creation of a virtual patient record;

## DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

### Overview

The prescription management system illustrated in Figures 1-

1 14 can be provided in software for single-user operation on  
2 a stand-alone personal computer for use, for example, by a  
3 sole practitioner or for multi-user operation on a local  
4 area network for use, for example, by physicians and other  
5 prescribers within a single facility, hospital, group  
6 practice, or the like prescribing organization, and the  
7 invention can bring substantial benefits to such users and  
8 their patients.

9  
10 However, more significant benefits can accrue to patients,  
11 physicians, drug benefit providers and the public at large  
12 by implementation of the described prescription management  
13 system on a regional or nation-wide basis. To this end, a  
14 preferred embodiment of prescription management system  
15 comprises a host computer facility supporting wired or  
16 wireless network delivery of user-relevant components of  
17 said prescription management system to multiple remote user  
18 interface devices.

19  
20 The host computer facility provides data, or access to data,  
21 data processing and communications resources for users to  
22 draw upon via the user interface devices. The host computer  
23 facility can be a server or cluster of servers with  
24 associated data storage volumes, and at least one  
25 intelligent client providing access to the server or  
26 servers. As will be explained in more detail hereinafter,

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1 especially with reference to Figure 16, the host computer  
2 facility can call upon a variety of external resources and  
3 functions as a marshalling and processing center for  
4 organizing resources into useful and manageable pieces for  
5 utilization by limited capacity user-interface devices. In  
6 a preferred embodiment it is a co-ordination point on a  
7 network for a number of user-device clients. Preferably the  
8 network accesses or includes a number of remote database  
9 sources providing useful information elements to the system.  
10

11 Referring to Figures 1 to 14 of the drawings, the screens  
12 shown employ user-friendly data selection and data entry  
13 devices, such as are familiar to many computer users in Apple  
14 Corporation's Macintosh® (trademark) and Microsoft  
15 Corporation's Windows operating systems, for example  
16 activatable buttons, pointers, scroll bars, icons, arrow  
17 key, drop-down menus, windows and other screen symbols  
18 designed for actuation by a pointing device, for example, a  
19 mouse or trackball. More preferably, for compact "pocket-  
20 book" computer applications, the pointing device is a pen or  
21 stylus.  
22

23 The prescription management system shown in this embodiment  
24 of the invention has been designed for implementation on  
25 physically compact, portable, user-interface devices such as  
26 small portable personal computers, especially hand held

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1 devices known as personal digital assistants. Those skilled  
2 in the art will understand that the system can readily be  
3 used on or adapted to other hardware platforms, for example,  
4 a physician's desktop computer and can be expressed in  
5 different software interfaces from that shown, especially  
6 ones that use different input devices such as keyboards,  
7 touch pads or touch screens and the like.

8  
9 Pursuant to certain user-adaptive aspects of this invention,  
10 the screens automatically personalize themselves, with use,  
11 to adopt the patterns and habits of a regular user of a  
12 particular device platform for the system, offering the user  
13 their most frequently used information, drugs, conditions,  
14 patients or patient groups, and so on as first line choices.  
15 This adaptive characteristic is a valuable benefit endearing  
16 the system to experienced users who may become impatient  
17 with hierarchically accessed data.

18  
19 Ease of use and suitability of the system to keyless or  
20 minimally keyed platforms, especially PDA's is promoted by  
21 minimizing the need for actual text or data entry by the  
22 user and by emphasizing instead data selection from  
23 extensive, preferably comprehensive, data lists. Preferred  
24 embodiments of the invention allow quick pen selection of  
25 data items through columnar pick lists.

26

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1 The data lists, categories, groups, addresses or routes, can  
2 be organized in multiple hierarchies for rapid and flexible  
3 access to multiple large, remote databases, via multiple  
4 access routes to retrieve multiple related data elements and  
5 assemble them into a single data file, for example, a  
6 patient history file compiled from the data resources of a  
7 patient's historical health providers.

8

9 A desirable goal is to provide the physician-user with  
10 intelligent data lists that are, where possible, exhaustive  
11 and list, for example, all prescribable drugs, all  
12 conditions, all formularies or all patients and present the  
13 physician with helpful first-line choices or defaults  
14 selected intelligently on the basis of historical data known  
15 to the system. Preferably, the selection means is fully  
16 system embodied, or automatic, operating transparently to  
17 the user and requiring a minimum of configurational or setup  
18 operations by the user.

19

#### 20 Virtual Patient Record

21 An ability to compile what may be termed a "virtual" patient  
22 record from multiple remote databases of primary source  
23 information is a valuable novel feature of preferred aspects  
24 of this invention. Such a virtual patient record can be  
25 created in a chronologically current version by online  
26 interrogation of all possible primary sources of

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1 electronically recorded patient history elements, by  
2 retrieving those elements and assembling them into a  
3 complete record. Yet the record need neither be drawn from,  
4 nor committed to, permanent storage, obviating storage  
5 requirements for accumulations of patient records.

6  
7 The record can be assembled dynamically, on an as-needed  
8 basis, consulted by an authorized system user, and then  
9 dissolved, without ever having been saved, giving the record  
10 a virtual character.

11  
12 Record element retrieval and record assembly are conducted  
13 under the auspices of the host computer facility employing a  
14 novel patient data directory service providing routing  
15 information to each patient's record elements. For each  
16 patient, the patient data directory service lists all  
17 institutions, including independent physicians, hospitals,  
18 HMO's, insurance companies, and so on, known to have source  
19 historical records on that patient, against a unique patient  
20 identifier, such as described hereinbelow. Also listed are  
21 routing or address data enabling the host facility to access  
22 institutional databases to retrieve record elements. Access  
23 protocols detailing, for example, what data can be accessed,  
24 when it may be accessed, by whom or by what organization or  
25 department it may be accessed, can be kept in a patient-  
26 specified directory, or elsewhere.

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1 Patients not listed in the directory service can be searched  
2 at the remote source databases and, optionally, at other,  
3 host computer facilities supporting the inventive system for  
4 other groups of users.

5

6 The complete, assembled patient history, or record, need  
7 never be stored, unless the patient requests or consents to  
8 such storage, and it serves some useful administrative or  
9 care-related function. Storage or archiving of a record  
10 that is potentially updatable from multiple uncoordinated  
11 locations has the drawback of dating it. To become current,  
12 the record must be refreshed from any database containing a  
13 new data element for that patient.

14

15 By using a dynamically assembled virtual record, and never  
16 storing it, potential problems of maintaining patient  
17 confidentiality and preventing unauthorized access to highly  
18 sensitive personal information can be mitigated or avoided.  
19 This aspect of the invention avoids proliferation of a  
20 patient's confidential history and permits primary source  
21 data proprietors to act as exclusive wardens of their  
22 individual confidential data elements.

23

#### 24 Bio-pattern recognition

25 Bio-pattern recognition of personal user characteristics  
26 including, for example, handwriting, signatures, voice

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1 patterns and fingerprints is an attractive medium for  
2 accepting user inputs, but in the present state of  
3 development of the technology, suffers drawbacks which  
4 disfavor use of bio-pattern recognition in preferred  
5 embodiments of the invention. Future developments such as  
6 greater processing capabilities in small user-interface  
7 devices, and more accurate and efficient bio-pattern  
8 recognition techniques may change this picture and favor  
9 adoption of one or more forms of bio-pattern recognition.

10  
11 Thus, handwriting recognition, is eschewed in preferred  
12 embodiments of the invention, at the present time, because  
13 writing is more tiresome to the user than pointing, pressing  
14 or clicking and adds complexity and processing overhead to  
15 the system. Additionally, handwriting recognition, although  
16 presently available in pioneer systems, adds uncertainties,  
17 may require significant user effort or adaptation and may  
18 threaten data accuracy or promote user error.

19  
20 Signature recognition may be desirable, if permitted by  
21 regulatory agencies, for remote electronic authorization of  
22 fulfillment at the pharmacy especially for mail order  
23 prescription fulfillment and the pharmacy-prescriber link  
24 can, if desired, add additional levels of security by  
25 transmitting or exchanging supplemental electronic  
26 identifiers.

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1 However, better security, in terms of ensuring that the  
2 filled prescription is released to the intended patient, or  
3 their agent, may be provided, by treating an electronic  
4 prescription transmission to a pharmacy as an advisory  
5 against which fulfillment may be initiated, while the  
6 prescription is released only in exchange for a manually  
7 signed hard (paper) copy. Signature recognition or  
8 transmission as an individual graphic element, insofar as it  
9 may be useful or required in the prescribing process, can  
10 accordingly be incorporated in systems according to the  
11 invention. Processing demands on the user's device can be  
12 minimized by confining the device's capabilities to  
13 recognition of the signatures of only those users authorized  
14 to use that particular device.

15  
16 Adding higher performance hardware to support the processing  
17 needs of handwriting recognition may be impossible with  
18 available technology if a preferred lightweight, compact  
19 form factor is to be retained for the user's device. An aim  
20 of the invention is to provide a qualified prescribing  
21 professional with a valuable tool that imposes no  
22 significant burdens of weight or volume on the user, that  
23 demands little of their time and yet can respond rapidly,  
24 delivering valuable drug and patient information to the user  
25 from remotely located, disparate sources. In other words,  
26 an aim of the invention is to provide an intelligent,

1 knowledgeable computerized prescription pad.

2  
3 This aim could be compromised by adoption of handwriting  
4 recognition technology at the date of this application.  
5 Similar problems apply to voice recognition as a significant  
6 data input medium. Either or both handwriting and voice  
7 recognition may be valuable enhancements of future  
8 embodiments of the inventive systems especially if future  
9 technology makes these capabilities available on smaller  
10 user devices. In particular, limited voice recognition may  
11 be valuable as a user identifier for password access or as  
12 an authorizing signature.

13  
14 Security

15 Security may be provided by password protection operating  
16 hierarchically on one or more levels, to provide varying  
17 degrees of access according to the user's level of  
18 authorization, as desired. Additional password or numeric  
19 code control may protect sensitive system-accessed  
20 information, for example, patient records, or parts thereof,  
21 or physician-user data, including personal lists and  
22 prescribing profiles.

23  
24 Patient record access codes can, in selected instances, be  
25 patient provided, or granted by intelligent security control  
26 cards, having been furnished to the patient by a system

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1 administrator, or agent, prior to the physician encounter.  
2 Physician or other user access to a patient's record, or to  
3 sensitive details thereof, can thereby be restricted to a  
4 need-to-know basis. Access by third parties to physician-  
5 related data can be similarly protected.

6  
7 Provision for override of such security features should be  
8 available, for example for an emergency room doctor, and is  
9 allowed on a special case exception basis, is auditable, and  
10 traceable to the overriding user.

11  
12 Password-controlled access to many computer networks is  
13 often workstation dependent with each workstation using a  
14 unique password to access the network. Although user  
15 passwords may also be employed, these are often workstation-  
16 dependent, for example, being incorporated in the  
17 workstation's login scripts. In contrast thereto the  
18 present invention prefers that user access to the host  
19 computer facility be device-independent so that a given user  
20 can access the system via any of numerous devices, provided  
21 they have the right password or passwords. By this means,  
22 users are not dependent upon a single device that may be  
23 lost or misplaced.

24  
25 A still more preferred feature is to have user passwords  
26 which link each user with an individual profile or style

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b  
1 sheet on the host computer facility representing the user's  
2 pattern of preferences so that the user-customization  
3 features of the system, which will be described more fully  
4 hereinafter, are readily available to the user independently  
5 of the particular interface device that happens to be  
6 employed for accessing the system.

7  
8 These and other device-independent features can permit the  
9 prescription management system to be fully operative without  
10 committing useful data to storage on the user device. This  
11 is a valuable security feature. In the event of theft or  
12 attempts at unauthorized use, even by skilled third parties,  
13 a user device will be worthless as a means to access  
14 sensitive data on the system or to use the system illegally.

15  
16 Optionally, lost or stolen devices can be deactivated by the  
17 application or by system software, after user notification,  
18 by erasing or otherwise rendering device-resident  
19 application procedures inoperable, without loss of device-  
20 resident data. Use of a virtual patient record, as  
21 described herein, which need not be stored locally, is a  
22 valuable safeguard against unauthorized access of  
23 confidential data on lost, stolen or "borrowed" user  
24 devices.

25  
26 Host computer facility

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1 Currently contemplated preferred embodiments further control  
2 the processing and storage demands placed on the user's  
3 device by intelligently delegating data-processing and  
4 storage activities to a linked remote, host computer  
5 facility, as referenced above, to the extent warranted by  
6 the capabilities of the user device. Thus, for example, a  
7 comprehensive drug database may be stored and maintained on  
8 such a host computer facility with selected data, for a  
9 particular drug list or an individual drug's formulation  
10 characteristics, being forwarded to the user's device on an  
11 as-needed basis, then being eliminated from the user device  
12 when no longer required. Other activities may  
13 advantageously be performed locally on the device, such as  
14 dynamic assembly of records from elements retrieved across  
15 the network from remote storage, and storage of the user's  
16 personal or most frequently referenced data and data lists,  
17 where the device's capabilities permit.

18  
19 Where the user device is more powerful than present-day  
20 PDA's, for example a present-day desktop computer or perhaps  
21 the PDA's of the future, more processing and data storage  
22 functions can be retained at the user device rather than  
23 delegated to the network. Although permanent (disk,  
24 diskette or flash memory) storage may have uses, security  
25 concerns can be better managed on the network than on the  
26 user device, so that it is preferred that minimal data be

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4

5

1

1 work flow.

2

3 In addition, the screens are laid out in the manner of  
4 appealing logical forms that echo familiar data formats  
5 encountered by a physician in their day-to-day work. An  
6 important objective is to make the screens self explanatory  
7 within the professional's normal terms of reference so as to  
8 avoid any need for access to help, although of course, HELP  
9 buttons can be provided if desired and extensive help  
10 documentation can also be provided. System utilities such  
11 as indexing, setup and purging are either concealed from the  
12 user or removed for execution on a remote host computer  
13 facility. Data integrity and availability responsibilities  
14 are also delegated to the host computer facility, or its  
15 remote data suppliers. Thus data saving, archival, backup  
16 and data-replication functions are host facility  
17 responsibilities, not concerns of the user.

18

19 The system is designed to require a minimum of actual text  
20 or data entry. So far as possible, item entry is effected  
21 by selection from lists of items, for example by  
22 highlighting an item, then clicking a mouse, or more  
23 preferably penning, to activate an item.

24

25 The prescription management system is made as user-friendly  
26 to physicians as possible, for example, by using familiar

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1 professional terminology and abbreviations. Thus terms such  
2 as "Patient" or "Pt", "Drug" or "Rx", "Condition" or "Dx"  
3 and "Treatment" or "Tx" are used rather than confusing  
4 generalities such as "subject" and "item" that often appear  
5 in generic software. The Prescription Management System  
6 shown in this embodiment of the invention has been designed  
7 for use with small portable personal computers, especially  
8 hand held devices known as personal digital assistants.  
9 Those skilled in the art will understand that the system can  
10 readily be used on or adapted to other hardware platforms,  
11 for example, a physician's desk top computer and can be  
12 expressed in different software interfaces from that shown.

13  
14 Referring now to Figure 1 the system entry screen  
15 illustrated has a user-customizable button bar 10 which has  
16 been set with a conventional Quit button 12 and a Help  
17 button 14, along with a Mail button 16 for accessing an  
18 electronic mail ("E-Mail") system, a Prescribing button 18  
19 for accessing the prescription management system embodiment  
20 of the invention, an Encounter button 20 for accessing a  
21 patient encounter management system (not further described  
22 herein). Ans Svc button 22 accesses an answering service  
23 screen (not shown), which as a convenience function can be  
24 dynamically linked via the host computer facility to log  
25 incoming calls for the user. The answering service is  
26 preferably intelligent and prioritizes, by flagging or

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1 displaying, patient- or treatment-related calls, for example  
2 those from a pharmacy, while screening out or de-prioritizes  
3 less relevant calls.

4

5 History-cognitive drug and condition listing

6 A Doctor's Lists button 24 accesses a more or less complex  
7 <sup>library</sup> display of patient condition and therapeutic drug lists.

8 Preferably, the drug and condition lists are linked together  
9 to associate a drug with one or more conditions for which it  
10 might be prescribed and, in most cases to provide the  
11 physician user with a conveniently displayed, concise  
12 selection of drugs for treating any particular condition.  
13 In a preferred feature of this invention, the system has a  
14 user-adaptive character and adapts itself to the user's  
15 habits and prescribing patterns so as to service the user  
16 more efficiently. To this end, the drug lists or the  
17 condition lists, or both, are <sup>system generated</sup> system-modified with use to <sup>block 123 (Fig. 21)</sup>  
18 reflect the prescribing frequency of particular drugs, <sup>100K 87</sup> or the  
19 frequency of occurrence of particular conditions. <sup>block 89</sup> Thus,  
20 more frequently prescribed drugs or more frequently  
21 encountered conditions can be presented to the user  
22 physician in a more prominent manner or more immediate  
23 manner than ones found by the system to be historically less  
24 common in the particular user prescribing environment. In  
25 this way the system becomes more valuable with use as the  
26 drug and condition lists develop into personalized lists

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1 featuring the user's preferences.

2

3 With such cognitive features the inventive system is  
4 effectively cognizant of ongoing prescribing activity. It  
5 comes to know its user's environment and preferences, can  
6 adapt itself to any number of specialist situations, and  
7 can, if suitably equipped, subtly prompt the user, online  
8 with original, relevant, but elusive information derived  
9 from the user's computer-memorialized practice experience.

10 For example the system may prompt the user that the last  
11 time Drug X was prescribed for Condition Y, Patient Q  
12 reported adverse reaction Z. Where the host computer  
13 facility documents a catalog of known adverse reactions to  
14 system-listed drugs, a system enhancement can report new  
15 adverse reactions to the user or centrally, to the host  
16 computer facility, by tracking logged patient conditions and  
17 relating them, where appropriate, to a previous  
18 prescription. In similar manner the system may log drug-  
19 drug interactions, which interactions can also be associated  
20 with a target condition or conditions. Many other valuable  
21 retrospective statistical studies and analyses are made  
22 possible by deployment of the invention, as will be apparent  
23 to those skilled in the art. While such studies are  
24 potentially of immense public value if widely implemented,  
25 careful controls will be required to avoid reporting  
26 unrelated conditions as adverse drug reactions.

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1 With time, as it adopts appropriate specialist prescribing  
2 patterns, the user-adaptive prescription management system  
3 of the invention can be just as relevant and useful to, for  
4 example, a specialist in tropical medicine as it is to a  
5 pediatrician. This desirable result can be achieved without  
6 encumbering either specialist with the needs of the other.  
7

8 Those skilled in the art will appreciate that the  
9 invention's cognitive, user-adaptive features employ  
10 significant programming routines and procedures and are  
11 quite different from common, user-responsive software  
12 defaults which merely offer defaults pre-set by the user or  
13 simply show the last used item, file or the like as a  
14 default.  
15

16 If desired, the user's prescription management system can  
17 have built-in, online, statistical reporting functions  
18 enabling a physician user to review their, or others,  
19 historical experience with a particular drug or condition  
20 and providing online historical review of any other  
21 activities or data entrusted to the system.  
22

23 Of scientific note is that the system is privy to and  
24 operates at the confluence of three powerful emergent data  
25 streams: encyclopedic data on therapeutic agents intended to  
26 moderate particular conditions or patient problems; data on

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1 individual prescriber activity using skill and judgment to  
2 diagnose conditions or problems and make prescribing  
3 decisions selecting and applying therapeutic agents to  
4 diminish diagnosed conditions; and patient history data  
5 recording not only prescribing decisions but also the  
6 results of those decisions (see the description of Figure  
7 12, below). Thus, the system captures not only prescribing  
8 activity but also the *prescriber's intent*, the problem or  
9 condition targeted by the prescriber in specifying a  
10 particular drug, and can track the success of that intent.  
11 The linkage of treatment with condition treated captures the  
12 reason why the doctor took the prescribing action that was  
13 taken. This intent may, and can legally, be different from  
14 approved FDA therapeutic indications for a drug.

15

16 Of commercial note is that the foregoing data may be  
17 aggregated for multiple users, for example by the host  
18 computing facility, for market research purposes. Also, an  
19 individual user's prescribing patterns may be reviewed by  
20 the user or by others. For example, drug benefits  
21 companies, can review the user's prescribing patterns for  
22 formulary compliance and respond by encouraging better  
23 compliance, where appropriate. Release of such data to  
24 third parties can be controlled to safeguard the privacy of  
25 the prescriber, or other health care provider, by  
26 prescriber-determined data access protocols specifying who,

1 or what organization, department or group, may access what  
2 data, when they may access it and what they can do with it.  
3 For example, one physician may permit academic use for  
4 research studies and prohibit commercial use while another  
5 may permit either.

6  
7 As will be described in more detail subsequently, a range of  
8 optional features, for example the answering service and e-  
9 mail features mentioned above, or other communications  
10 features, can be made available from button bar 10 providing  
11 the user with user-configurable means to customize the  
12 system to their personal needs and tastes.

13  
14 Intelligent drug-selection procedure

15 Skeptical prescribers are encouraged to adopt the  
16 prescription management system of the invention, by its  
17 ability to bring to the point-of-care, in readily utilizable  
18 form, a battery of relevant drug-specification information  
19 and important patient-related information, much of which is  
20 not readily accessible at the point-of-care by conventional  
21 means.

22  
23 Preferred embodiments of the invention achieve this  
24 desirable result by providing an intelligent drug-selection  
25 procedure which is supported by transparent connectivity to  
26 multiple remote proprietary information systems at the point

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1 of care, enabling a physician to draw upon the following  
2 categories of data:

- 3 i) physician-user prescribing-frequency data;
- 4 ii) patient drug formulary information as to a drug's  
5 status with a patient's drug benefits provider;
- 6 iii) drug dosage characteristics, for example, form,  
7 size, route of administration, amount, frequency  
8 and the like;
- 9 iv) drug-specific treatment information as to  
10 condition-related efficacy, and preferably as to  
11 contraindications and adverse reactions;
- 12 v) relevant patient history information as to current  
13 and previous prescriptions, and preferably also,  
14 pursuant to the teaching of the present invention,  
15 problem-history information; and
- 16 vi) laboratory and other diagnostic test information  
17 related to the patient's indications, to dosing,  
18 to therapeutic choices or to specific drug  
19 selections.

20  
21 Preferably, this data is brought to the point-of-care by  
22 relying upon retrieval from remote source databases at  
23 remote facilities responsible for capturing original update  
24 data, and not by relying upon redundant non-source data  
25 requiring constant synchronization with source data to  
26 remain current.

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1    **Diagnostic tests**

2    Items i)-v) above, will be described in considerable detail  
3    hereinafter. With regard to diagnostic tests and  
4    procedures, for example radiology, the invention  
5    contemplates electronically bringing relevant information to  
6    the point of care to assist health care providers make  
7    informed decisions. Such diagnostic information may  
8    comprise recommendations for clarifying a tentative  
9    diagnosis, or choice of diagnoses, or may comprise  
10   diagnostic results that can be used to make more informed  
11   therapy decisions and, in particular, to make better  
12   therapeutic drug selections. Body system function tests,  
13   for example renal or liver function tests are clearly  
14   valuable to a drug selection process, since renal and liver  
15   condition are important in determining dosages of some  
16   medications. Other therapy-relevant diagnostic  
17   determinations can usefully be presented at the point of  
18   care, by means of the present invention, for example, drug-  
19   level determinations can enhance dosing decisions.

21   **Patient encounter program**

22   A useful, prescription management system-compatible patient  
23   encounter program can begin with a patient selection screen  
24   such as that of Figure 2. The patient selection screen of  
25   Figure 2 can be activated by any one of multiple programs  
26   which may, for example, be initiated via the system entry

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1 screen of Figure 1, but could be independent, free-standing  
2 programs or any other program for which the ability to  
3 create, update and modify a patient-specific record or a  
4 patient history is valuable.

5  
6 Preferred embodiments of software procedures (or programs)  
7 associated with the novel patient record selection procedure  
8 illustrated in Figure 2 can access multiple remote databases  
9 to retrieve patient records, for example, by using the host  
10 computer facility, and can also post new patient records,  
11 and updates, created locally by the physician-user, to the  
12 multiple remote databases in real time, or in batch mode.

13  
14 Patient record source data

15 Source data for a typical patient record may be distributed  
16 across multiple, geographically dispersed, electronically  
17 incompatible, remote databases maintained for example by  
18 drug benefit companies, insurers, laboratories, medical  
19 facilities, diagnostic testing facilities and health  
20 maintenance organizations, including government agencies  
21 (MEDICAID, MEDICARE, etc.) and health care providers  
22 themselves, that have serviced the patient in the past.

23 Known automated patient record systems either ignore such  
24 remote data and work only with data created at the  
25 maintaining facility or vertically integrated health care  
26 organization, or create and maintain duplicates of the

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1 remote data.

2

3 Still more preferred embodiments of the invention provide  
4 substantial savings of resources, time and effort by using  
5 only source data for patient records, minimizing creation of  
6 multiple redundant local databases that require constant  
7 synchronization with remote sources if they are to remain  
8 accurate and up to date.

9

10 The invention also provides novel data-retrieval network  
11 systems to retrieve relevant patient data elements from  
12 multiple remote heterogenous primary source databases.  
13 Preferably, every time a host computer facility receives a  
14 call from a user device for a patient history or patient  
15 record, relevant data elements, for that record, or a record  
16 component (e.g. the most recent six-month or twelve-month  
17 portion), are retrieved from remote source databases,  
18 dynamically assembled, or integrated, into a virtual patient  
19 record, as described above, and delivered to the user device  
20 as an integral system data set. Alternatively, record  
21 assembly, which does not require undue hardware resources,  
22 can be performed on board the user device.

23

24 The record is viewed and may be printed out by the user,  
25 with patient authorization, but does not need to be  
26 permanently stored.

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1 The host computer facility responsible for dynamic assembly  
2 of the virtual record logs the time, date and calling user  
3 to provide an audit trail of access to the patient's record,  
4 but does not commit the record to permanent storage. After  
5 use, the virtual patient record disappears, although it can  
6 be reconstructed archivally.

7  
8 If the record is required again, it is assembled anew,  
9 thereby incorporating any updates that may have occurred in  
10 the interim, for example changes in drug benefit status,  
11 insurance coverage or the like, newly generated laboratory,  
12 radiology or other diagnostic results, or other, e.g.  
13 emergency, prescriptions dispensed. The act of assembling a  
14 record externally of its sources immediately dates the  
15 record: it is cut off from any updates, and therefore liable  
16 to become incomplete, obsolete or dated. Virtual patient  
17 record assembly, as described herein, avoids this problem  
18 making local storage of patient records unnecessary.

19  
20 Transactions are archived by the host system to provide a  
21 complete transaction history, so that past activity can be  
22 reconstructed. Such a data-reconstruction capability to  
23 provide clear hind vision of the patient's record at any  
24 given time is an important medicolegal capability. That  
25 historical version is preferably reconstructed from a  
26 transaction log and assembly of timed and dated record

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1 elements, or segments, in a manner not unlike that used by  
2 version control software.

3

4 Creating a virtual patient record permits optimal data  
5 currency and accuracy and, by avoiding unnecessary redundant  
6 copies of patient data minimizes liability for misuse or  
7 unauthorized access. Patient confidentiality can be  
8 maximized and is verifiable by the system-generated audit  
9 trail.

10

11 Preferably for individual record elements to be admitted to  
12 the system, they are required to be at least dated and  
13 preferably also to be timed at source, such timing and  
14 dating relating to whatever event created the record. In  
15 addition to its value as an integral record characteristic,  
16 chronological data is useful for retrospective archival  
17 reconstruction of a record as it existed (in its elements)  
18 at any given point in time. This can be achieved by  
19 retrieving record elements, as described above, using a  
20 suitable date filter and if appropriate, a time filter, to  
21 include only those (or selected ones of those) record  
22 elements that existed at the desired given point in time.

23

24 Such an archival retrospective record reconstruction  
25 capability is a highly desirable adjunct to the virtual  
26 patient record described herein permitting full creation and

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1 examination of any desired historical records, such as may  
2 be required for review or legal purposes.

3

4 Using the above-described method of dynamic retrieval from  
5 remote databases across a data-retrieval, record-integrating  
6 network, source database proprietors can remain wardens of  
7 the only copy of that data and obtain patient authorization  
8 to be the sole repository of that data. Laboratories can  
9 keep laboratory records; insurance companies can keep  
10 insurance records; hospitals can keep hospital records; and  
11 health maintenance organizations can keep their own records;  
12 without ever having to release copies of these records into  
13 external electronic storage by third parties, with the  
14 security hazards attendant upon such releases. Any  
15 electronic release made externally using the data access  
16 control features described herein can be assured of always  
17 being authorized by whatever entity, be they patient,  
18 physician or organization, that has proprietary rights in  
19 the data.

20

21 **Figure 2: Patient selection screen**

22 Upon selecting Prescribing button 18 by clicking or pen  
23 contact, a <sup>Select Patient screen 46</sup> ~~patient selection screen~~, for example as shown in  
24 Figure 2, is displayed as a preliminary to prescription  
25 management functions. Referring to the patient selection  
26 screen of Figure 2, <sup>and the selection of Figure 17</sup> the name, age, gender, and social

1 security numbers of patients who have authorized the user  
2 physician to treat them, or to access the system on their  
3 behalf, are listed under respective column header buttons,  
4 namely, **Name** button 26, **Age** button 28, **Gender** button 30 and  
5 **Social Security #** button 32.

6  
7 Lists can be scanned, or text entries made in a blank search  
8 box 34 at the top of the screen, using string or full name  
9 searches to locate the desired patient or to review the  
10 patient list. Column headers 26-32 can be clicked or  
11 touched to sort the patient list on any of those fields and  
12 activate search box 34. Search box 34 is linked to the sort  
13 fields so that, for example, if the listing is sorted by  
14 social security number then alphabetical entry attempts are  
15 rejected from search box 34 and numeric entries are used as  
16 social security number locators. The characters can be  
17 keyed or system provided from pop-up screens, or voice or  
18 handwriting recognition may be employed.

19  
20 *To select Patient screen 44*  
21 **New Pt** button 36 activates a new patient entry bar, while  
22 the **Ok** button 39 accepts a highlighted patient selection and  
23 advances to the prescription management screen of Figure 3.  
24 **Cancel** button 38 returns to the system entry screen of  
25 Figure 1.

26 If desired, preliminary selection of groups of patients can

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1 be made by providing various patient lists, for example  
2 "Today's Patients", "In-Patients", "Out-Patients", "Private  
3 Patients" and the like. Such patient lists are preferably  
4 system-maintained, on an ongoing basis, using the latest  
5 data available to the system and preferably enable the user  
6 to select a convenient group of patients that has a high  
7 probability of including the next patient or patients to be  
8 encountered, thereby speeding access and retrieval of a  
9 desired patient record. Where the user typically encounters  
10 patients in groups, for example one group in an out-patient  
11 clinic and another group in an in-patient clinic, such  
12 grouping of patient records into lists also facilitates  
13 organization by a host computer facility of display data  
14 into small batches that can more rapidly be communicated via  
15 limited capacity copper wires and modems and are of a size  
16 that can conveniently be held in RAM on a small, portable  
17 user device.

#### 18 19 Patient Data Security

20 Critical to public confidence in the prescription management  
21 system of the invention are issues of security, since the  
22 system requires access to personal records. Many people  
23 will fear unauthorized access to or use of their personal  
24 information. Preferably, the invention provides careful  
25 controls to alleviate such fears and to prevent unauthorized  
26 access to a patient's data or to their physician's

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1   prescribing profiles.

2

3   Preferably also, the system, or an associated support  
4   network, provides data access controls such that the only  
5   accesses that can occur are those that have been authorized  
6   or preauthorized, at a point of care or elsewhere, in  
7   accordance with security profiles on the network established  
8   on behalf of data-proprietor entities such as patients,  
9   physicians or organizations. It is further preferred that  
10   the entity's security profile, or filter, details what data  
11   can be accessed, when it may be accessed, where it may be  
12   accessed and by whom it may be accessed.

13

14   Various suitable data access control measures will be known  
15   to those skilled in the art and considerable security can be  
16   obtained by using more or less complex identifiers for  
17   patients or for physician-users of the system or for both.

18

19   Patient records should use a standard identifier to be  
20   clearly and distinctly identified with a confidence level  
21   appropriate to the expected patient population in the  
22   lifetime of the system so that the records of patients with  
23   similar or identical names are not confused. If desired, a  
24   coded alphanumeric patient identifier (not shown) may be  
25   used. Alternatively, or in addition, other unique patient  
26   identifiers such as social security numbers may be used

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1 alone or as secondary references in conjunction with patient  
2 names and the like.

3

4 More relevant to security is proper identification of a user  
5 to whom patient data is released or from whom new data is  
6 received by the host computer facility. While numeric or  
7 alphanumeric user identification codes provide some level of  
8 security, higher levels are provided by using graphic,  
9 photographic or fingerprint recognition to identify a system  
10 user.

11

12 More preferred embodiments of the invention can ensure a  
13 still higher level of confidentiality by automatically  
14 maintaining a complete audit trail of access to patient  
15 data. Preferably the audit trail details, for every access,  
16 who or what organization accessed the record, what part of  
17 the record was accessed, when it was accessed (both date and  
18 time), and what was the purpose of viewing the record. Thus,  
19 associated with every patient record is a timed and dated  
20 log of every physician user, organization or health care  
21 professional accessing that record. If desired, the log can  
22 be reported, or made available to a patient, on request, for  
23 example through online access (with careful security  
24 controls), via print or fax, and so on.

25

26 Patient-directed control of the flow of their own data, a

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1 novel concept in medical or health care information systems,  
2 can be achieved by centrally inputting at the ~~or a~~ host  
3 computer facility patient-generated record-access  
4 specifications to determine which users, or user  
5 organizations or departments (for example clinics), can  
6 access what data during what period and what uses can be  
7 made of the data. Clearly, such specifications must not  
8 deleteriously restrict physicians in the execution of their  
9 professional missions. Such record-access specifications or  
10 profiles could be maintained at a remote database rather  
11 than the host computer facility. Thus, access to their  
12 records is controlled by patients and individuals and  
13 organizations can be given patient-defined, selective access  
14 or access based on a need to know, or a patient may block  
15 access to all data flow, if they wish. In emergencies,  
16 physicians may be able to override a patient security block,  
17 but such events are recorded so that any abuse can be  
18 monitored and action can be taken to discourage abusers.

#### 20 MD-Related Data Security

21 Many similar data security considerations apply to  
22 prescriber-related data. Used comprehensively, as it is  
23 intended to be, the system is privy to full particulars of a  
24 physician user's professional prescribing behavior, day in,  
25 day out, potentially throughout their career. System  
26 resources may be used to compile any desired historical

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1 record of a user's prescribing activities. Patient-  
2 confidentiality aspects of this data have been addressed  
3 above and can be satisfactorily managed by controlling  
4 access to patient-related data in accordance with a  
5 patient's previously, or currently expressed wishes, as  
6 described herein. In addressing physician-oriented  
7 prescribing issues, the historical record may be rendered  
8 patient-anonymous by stripping the data of recognizable  
9 patient identifiers, or aggregating the data. The resultant  
10 historical prescribing data can communicate significant  
11 information about the prescriber, is personal and  
12 proprietary to the prescriber.

13  
14 Pursuant to this invention, the prescriber's rights in their  
15 historical prescribing data are protectable in a manner  
16 similar to the protection affordable to patients, by  
17 providing prescriber-determined access control  
18 specifications detailing permissible levels of third-party  
19 access to prescriber data. Such prescriber data access  
20 control specifications can be stored in individual files on  
21 the network and can comprise as to who or what organization,  
22 or type of organization may access what data, for what  
23 purpose and for what period of time such access right may be  
24 effective. Clearly, multiple levels of access control may  
25 be described to any desired degree of complexity. User  
26 preferences may include user authorization for data access

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1 by various third parties for example health maintenance  
2 organizations (HMO's), hospitals, government agencies,  
3 managed care organizations and so on.

4

5 A particular group to whom a prescriber may wish to yield  
6 access rights comprises collective bargaining associations,  
7 for example independent practitioner associations, preferred  
8 provider organizations and physician hospital organizations.  
9 Preferably, all accesses to a prescriber's data are system  
10 stamped with a date, time and accessor ID, to create an  
11 audit trail of such accesses, similar to the audit trail  
12 left by accesses to patient data.

13

14 System-determined access control can be invoked, whenever a  
15 prescriber data access request is received, by referencing  
16 the prescriber's access control file and permitting or  
17 denying access in accordance with the file's specifications.

18

19 Prescription creation screen 39

20 Referring to Figure 3, prescription creation screen 39 has a  
21 full array of user-activatable buttons enabling a physician  
22 to draw on powerful resources within the prescription  
23 management system <sup>as well as</sup> ~~and supporting it~~ in the host computer  
24 facility and associated data-retrieval network, as will  
25 shortly be described. Near the top of screen 39 is a  
26 patient features bar 40 below which a prescription features

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1 bar 42 coordinates all features necessary to review current  
2 therapy and order changes in treatment, or order new  
3 treatment, for the selected patient. A prescription history  
4 zone 43 extends across the middle of the screen, the lower  
5 screen portion contains a prescribing zone 44, and a screen  
6 title 45 appears at the top of the screen.

7

8 Patient features bar 40 comprises a **Select Patient** button  
9 46, a selected patient indicator 48, in this case **Mary**  
10 **Harrington**, a patient **Problems** button 50 and a patient  
11 **Allergies** button 52. Beneath **Problems** button 50 are  
12 displayed Mary Harrington's currently active problems 51 or  
13 conditions, shown here as pharyngitis and bronchitis.  
14 Beneath **Allergies** button 52 are displayed Mary Harrington's  
15 known allergies. Pressing or otherwise activating **Problems**  
16 button 50 or **Allergies** button 52 opens a window or screen  
17 listing problems or allergies from which a physician, or  
18 other professional user, can select new problems or  
19 allergies to add to Mary Harrington's record, or delete ones  
20 that are no longer active. Optionally, system-provided  
21 problem or allergy libraries may be organized into multiple  
22 lists with button 50 or 52, respectively, opening a list  
23 selection box as a preliminary to displaying a selected  
24 problem or allergy list.

25

26 Problems or conditions 51 and allergies 53 are here

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1 displayed as a helpful notation for the prescriber and do  
2 not become prescription elements as a result of being  
3 selected for display in this part of the screen. However,  
4 selections made here are functional in that selected  
5 problems 51 (conditions) will become defaults or preferred  
6 choices in a subsequent condition specification procedure  
7 and the system will review any drugs prescribed for  
8 relevance to allergies 53.

9

10 Prescription features bar 42 comprises an Rx History button  
11 54, an Rx Options button 56, an Updating indicator 58, an Rx  
12 Info button 60 and a Renew Rx button 62.

13

14 Prescription history zone 43 displays those historical  
15 prescription details that may be relevant to a current  
16 prescription and has a Condition field 64, a Drug field 66,  
17 a Size field 68 a Dosing field 70, a generic flag 72, an  
18 Expires field 74 and a Mine field 76, in which the various  
19 characteristics of patient Mary Harrington's previous  
20 prescriptions are listed.

21

22 Prescribing zone 44 comprises three active buttons, New Rx  
23 button 78, Send Rx button 80 and Close button 82, below  
24 which extends a prescribing header bar 84 which contains  
25 field identifiers for data entry of a full complement of  
26 prescription details. Available prescription detail fields

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1 comprise a **Condition** field 86, a **Drug** field 88, a **Generic**  
2 field 90, a **Form** field 92, a **Size** field 94, a **Route** field  
3 96, an **Amt (Amount)** field 98, a **Refill** field 100, a **Dosing**  
4 field 102 and an **Expires** field 104.

5  
6 Multiple lines of the selected patient's prescription  
7 history are listed in patient history zone 43 in the middle  
8 of the screen for convenient review by the physician-user,  
9 and possible renewal, with scrolling or paging of extensive  
10 histories. Depending upon the patient's previous  
11 whereabouts and service providers, individual lines may come  
12 from multiple remote sources. Such histories are preferably  
13 compiled by the host computer facility in response to a call  
14 from the user device (see the description of Figure 16).

15  
16 Prescribing zone 44, lower down prescription creation screen  
17 39, allows a physician user to select and prescribe drugs  
18 and dosages, for the selected patient, in this case Mary  
19 Harrington, and to transmit the created prescription<sup>by activating the Send Rx button 80,</sup>  
20 externally across a data network to other interested and  
21 authorized parties for prescription fulfillment, patient  
22 record updating<sup>arrow 57,</sup> and the like.<sup>click 83</sup>

23  
24 **Select Patient** button 46 returns to the patient selection  
25 screen of Figure 2 for selecting a different patient from  
26 one or more lists. Preferably, **Select Patient** button 46

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1 draws up a "Today's Patients" list or whichever patient list  
2 the user last selected from, or a default, user-selected  
3 patient list, and provides the options of selecting a new  
4 patient from alternative patient lists.

5

6 **Problems** button 50 brings up a patient problem history  
7 information screen such as that shown in Figure 12 (to be  
8 described) in which a historical record of the patient's  
9 individual symptoms and diagnoses is listed and to which new  
10 problem reports can be posted. To maintain data integrity,  
11 and as a legal safeguard, historical information is not  
12 editable but may be supplemented, for example by reporting  
13 the subsequent status of a problem as (still) active or  
14 inactive. Preferably, any such additions to the record are  
15 stamped with the identity of the reporting physician,  
16 providing valuable elements of a treatment decision-making  
17 audit trail.

18

19 The patient's drug-related allergies, or drug reactions, are  
20 brought up in possibly editable form (screen not shown) by  
21 activating an **Allergies** button 48 and may be automatically  
22 system updated, if desired by adding newly reported drug  
23 reactions and allergies. Desired personal or drug records  
24 relevant to possible allergies of this patient may be  
25 summoned from the host computer facility, which may in turn  
26 call on the remote database data-retrieval network for

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**2**

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**D**

1

•

1 Pressing header buttons Condition 64, Drug 66, or Expires  
2 74 causes the drug history display to be sorted by the  
3 selected header enabling the prescription history to be  
4 evaluated according to a particular parameter. This feature  
5 is of particular value for patients with long and complex  
6 treatment histories.

7

8 An important novel feature of the inventive prescription  
9 management system is the ability to associate a specific  
10 patient condition with each drug prescribed. By capturing  
11 detailed information on every prescription the system  
12 automatically builds a novel patient medical record having  
13 new uses in evaluating individual patient treatment and in  
14 enabling powerful new, multi-center outcome studies for  
15 evaluating therapies in various populations of patients.

16

17 By deploying the inventive system regionally, nationally or  
18 in some other population area, and employing the preferred  
19 methods for retrieving patient data from remote sources, as  
20 described herein, a complete patient record of all activity  
21 within a region can be built. Preferably this is a virtual  
22 patient record dynamically assembled only from original  
23 source data, which, as described above, is maintained in  
24 component form at multiple distributed source databases, is  
25 retrieved therefrom across a data-retrieval network from  
26 which the source databases can be accessed, and is compiled

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1 or assembled into a single virtual or transient record that  
2 appears to the user as an integral system data resource.

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4 Outcome studies, prescription cost savings and drug alerts

5 Patient histories generated by the inventive system can show  
6 not only the drugs prescribed, but also the conditions for  
7 which they were prescribed, allergies, demographics,  
8 insurance coverage, treating health care providers, and so  
9 on. Known medical management systems do not provide  
10 listings associating each prescribed drug with a patient  
11 condition or problem, as reported to, or diagnosed by their  
12 physician.

13

14 Careful review of a patient's record for relationships  
15 between amelioration of problems and prescription of  
16 particular drugs can provide important information about the  
17 efficacy of a drug for a particular problem in a given  
18 patient. Review of a physician's prescribing record,  
19 detailing the various drugs selected to treat the different  
20 conditions exhibited by the patients encountered in the  
21 physician's daily practice, can reveal valuable information  
22 about the physician's prescribing practices and the degree  
23 to which they follow formulary guidelines.

24

25 This information is clearly of value to the individual  
26 physician and can, if desired, be enhanced by including in

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1 the problem record a condition severity rating, enabling  
2 declines (or increases) in severity to be reported. The  
3 resultant patient prescription history, replete with dated  
4 information as to patient problems, what drugs were  
5 prescribed to treat those problems, what forms, routes of  
6 administration and dosages were used and, by implication  
7 from the timing and nature of subsequent problems, what the  
8 outcome of that prescription was, provides a very attractive  
9 treatment evaluation tool to a physician, and a powerful  
10 inducement to any professionally conscientious physician to  
11 use the prescription management system of the invention.

13 Implementing the invention on a wider scale, valuable new  
14 outcome studies and clinical trials are easily, or even  
15 automatically, performed. One of many problems in  
16 successfully implementing the herein described prescription  
17 management system on a large scale is one of funding the  
18 system. Medical cost structures, with their reimbursement  
19 systems leave little scope for expenditure on aids to  
20 overall practice improvements which may have to be squeezed  
21 out of tight overhead budgets. Accordingly, significant  
22 cost to the physician user, or user's medical facility will  
23 be a major deterrent to system adoption. Preferably the  
24 system is provided to prescribing users on a low-cost or no-  
25 cost basis with funding from outside sources.



1 Implementation of the invention is expected dramatically to  
2 reduce the overall cost of prescriptions and this saving has  
3 been estimated to be from 20 to 40 percent of total  
4 prescription costs. Savings will accrue initially to the  
5 drug benefit management companies who reimburse the direct  
6 costs of most prescriptions, but can be expected eventually  
7 to be passed to corporations and consumers by way of lower  
8 drug benefit rates. Such savings realized on a national  
9 scale would amount to many billions of dollars and provide  
10 an avenue of reimbursement for system proprietors. In the  
11 early 1990's, the cost of prescription drug benefits is one  
12 of the fastest rising components of all health care costs.

13 a7>

14 Outcome studies produced by the system may have substantial  
15 value to various parties, and their sale can support system  
16 costs, as may formulary compliance savings. For example,  
17 drug efficacy data is of value to pharmaceutical companies,  
18 as is early warning data from reliable specialists regarding  
19 adverse reactions. Subject to confidentiality and other  
20 relevant controls, such data can be automatically compiled  
21 and readily supplied by system management, requiring only  
22 approval, not active participation by involved physician  
23 prescribers. Equally, the system may facilitate clinical  
24 trials by identifying health care providers or prescribers  
25 who would be likely participants in trials, based upon their  
26 having frequently diagnosed relevant conditions, or

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4

6

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$$=$$

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2

1 would be indicated for *H.pylori*-negative gastritis.

2

3 The system can also provide, preferably from source  
4 databases, complete prescription drug disclosure  
5 requirements as set forth by the FDA, including full  
6 cautionary information, for example as is now set forth in  
7 the Physicians' Desk Reference (Medical Economics) and  
8 Physician's GenRx (Denniston Publishing) knowledge of which  
9 by the prescriber may be necessary to avoid malpractice  
10 liability, and dissemination of which may limit a drug  
11 manufacturer's liability. Efficient promulgation of drug  
12 disclosure information to system users is tantamount to  
13 publication, yet can be more current than any printed  
14 document, and may be accepted as an alternative to hard copy  
15 publication or supersede it.

16

17 In addition, the system provides a valuable means for  
18 government agencies and others to communicate important  
19 messages, such as drug warnings and alerts, quickly and  
20 directly to physician users. Electronic mail accessed via  
21 Mail button 16 can be used for this purpose, and may include  
22 priority flags triggering screen alerts, but a much more  
23 powerful route for communicating warnings relating to  
24 particular drugs is to associate the alert with system  
25 information on the drug so that when a user calls up the  
26 drug in question, they receive the warning or alert, or

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1 other special message.

2

3 In the extreme case of withdrawal of a drug from the market,  
4 that fact can immediately be communicated to system users.

5 Thus a drug can be withdrawn from the market the same day by  
6 making a system entry preventing completion of a

7 prescription for the withdrawn drug. Alternatively, a  
8 warning can be posted directly to the prescription. Current

9 users of the medication can be identified from prescription  
10 history records, referencing not only drugs prescribed, but

11 also prescription expiration dates. Both the patient and  
12 their doctor can be notified immediately. In this case,

13 electronic mail is a preferred route for notifying the  
14 physician.

15

16 Relative cost-to-benefit data can also readily be prepared  
17 in outcome studies when individual drug costs are factored

18 into the data, and such cost:benefit data can, in some

19 circumstances have very substantial dollar value to drug

20 benefits management companies whose objectives are to

21 maximize the quality of care while minimizing the cost of

22 that care.

23

24 Pharmaceutical and managed care companies can gain marketing

25 benefits from use of the system to introduce new drugs or

26 new uses of old drugs to physicians, in a relevant manner,

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1 at a moment of peak interest.

2

3 Other benefits can be derived from outcome studies using the  
4 novel drug-prescribed and condition-treated data records  
5 provided by the prescription management system of the  
6 invention. For example, the appearance of a new patient  
7 problem may be insignificant when associated with prior  
8 prescription of a particular drug for one patient, but may  
9 gain significance when repeated for a number of patients.

10

11 Optional system enhancements may enable post-introduction  
12 market surveillance of new drugs to be conducted for adverse  
13 outcomes to the treatment of a specified condition or  
14 conditions. For example the system may monitor patients  
15 reporting new problems after having been prescribed the new  
16 drug in question, refer such new problems to the physician  
17 user to qualify them for medical relevance and then  
18 statistically compare a collection of similar reports with  
19 data on a pool of similarly treated patients for  
20 significance.

21

22 Continuous post-market-introduction monitoring of a drug in  
23 relation to the treatment of conditions is possible, and an  
24 end-to-end solution to the problem of managing unanticipated  
25 problems arising with new drugs can be provided: the system  
26 provides a vehicle <sup>data</sup> collecting relevant data; parameters

1 and a means for analysis of that data; and a means for  
2 disseminating alerts and advisories regarding newly  
3 discovered problems. The same vehicle is used for all three  
4 steps.

5  
6 With such a system enhancement, one specialist pioneering a  
7 new drug for a particular condition may provide an early  
8 warning of adverse reactions not identified in clinical  
9 trials in a manner not heretofore obtainable, because of the  
10 difficulty of coordinating prescription and diagnostic data.

11  
12 Quickly and conveniently presented at the point of care, as  
13 an integral part of the prescribing process, in the manner  
14 achieved by the system of the invention, this information  
15 can be of immense value to a physician when treating a  
16 patient, widening the physicians' choices beyond their own  
17 field of knowledge (by suggesting new drug information) and  
18 helping the physicians optimize the prescribing process.

19  
20 Another advantage of the invention is that each physician  
21 user inherently and easily supplies critical enabling data  
22 for outcome studies as part of the prescribing process. No  
23 extra effort is required by the physician to make the data  
24 available for studies. One potential difficulty in making  
25 such studies is the existence of legal barriers to  
26 aggregating patient data into studies without specific

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1 patient permission. While this might be obtained on a  
2 piecemeal basis or by the prescribing physician, a much  
3 better solution is provided by centrally maintaining patient  
4 directed patient-record-access specifications, as described  
5 above. The system can then include only those records of  
6 patients agreeable to becoming study participants in such  
7 outcome studies.

8  
9 The historical drug-prescribed and condition-treated records  
10 obtainable by using the invention can provide a basis for  
11 condition-based treatment guidelines developed by drug  
12 formularies. This novel data provides a new vehicle for  
13 outcome research for managed care, leading to new approaches  
14 to cost-effective prescription treatments.

15  
16 Compilation of an extensive or national database of  
17 (patient-anonymous) records providing a statistical  
18 historical listing of drugs prescribed versus associated  
19 conditions for which they were prescribed would be in the  
20 public interest and of considerable value, so long as  
21 patient-confidentiality were maintained. Widespread  
22 adoption of the present invention can help achieve this  
23 desirable goal. It is relevant to note that FDA regulations  
24 only permit a drug to be promoted for approved, specific  
25 therapeutic purposes but physicians are professionally free  
26 to prescribe an approved drug for any condition for which

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1 they believe the drug to be effective or useful so that,  
2 failing specific point-of-care diagnostic information, no  
3 assumptions can be made as to the treatment objectives of  
4 any particular prescription. Accordingly, prior to the  
5 present invention, statistical prescribing data have  
6 generally lacked knowledge of why a physician prescribed a  
7 particular drug, and such data is, in most cases, not useful  
8 for outcome studies and cannot be related back to other  
9 patient-specific variables present in the patient's medical  
10 record.

11  
12 Prescription history record

13 Referring to the prescription history zone 43 of the Figure  
14 3 screen, under the Condition field 64 is listed a condition  
15 reported as active when the drug was prescribed. Drug field  
16 66 may be a generic name or a brand name. The Size field 68  
17 is the dosage size. Dosing field 70 shows the dosing  
18 frequency. The "G" flag 72 is for generic and is a simple  
19 yes/no indicator. An Expires field 74 displays an  
20 expiration date system calculated from the prescription  
21 quantity (not shown), the size and the dosing rate and  
22 indicates the day on which the prescription will run out.

23  
24 The last column, Mine field 76, is a yes/no toggle flag  
25 indicating whether the prescribing physician was the current  
26 system-designated physician user ("Y" = my prescription) or

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1 some other physician ("N"). Another prescribing physician's  
2 details and other data relevant to a previous prescription  
3 can be obtained by pressing Rx Info button 60, or double-  
4 pressing or -clicking on the appropriate prescription  
5 history line, to draw down a prescription information  
6 screen, for example, as shown in Figure 12. Additional  
7 available options, if any, can be accessed through the Rx  
8 Options button 56.

9  
10 Update button 58 can be a simple blinking indicator alerting  
11 the user that their device is communicating with the host  
12 computer facility and actively processing a local update.  
13 To indicate additional time taken accessing remote  
14 databases, the message can change to "Remote Retrieval", if  
15 desired. Additionally, Update button 58 can activate  
16 various update options, selectable from a menu, if desired.  
17 For example, Update button 58 may offer a selection of  
18 different sources from which to update the patient's  
19 prescription history. While a preferred objective of the  
20 invention is that the prescription management system obtain  
21 a comprehensive, nationwide update of any previous  
22 prescribing activity regarding this selected patient,  
23 considerations of system speed, system development or  
24 marketing considerations may make it desirable to offer  
25 patient prescription histories drawn from all prescribing  
26 activity in a more limited geographical region, for example,

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1 local or regional updates local network updates or  
2 capability to update from the physician's institutional or  
3 office practice information systems.

4

5 New prescriptions

6 Activating the New Rx button 78 highlights the first  
7 available blank line in the lower portion of the  
8 prescription management screen for creation of a new  
9 prescription by a physician-user. During the prescription  
10 creation process, the user receives intelligent decision  
11 support from the system of the invention. Preferably, the  
12 system proffers the prescribing physician comprehensive  
13 relevant prescribing data to enable creation of a new  
14 prescription intelligently, in an informed, manner with  
15 routine look-up functions being fully automated so that  
16 professional time spent on routine chores is minimized or  
17 eliminated. To this end, data entries available via both  
18 Condition button 86 and Drug button 88 are selectable from  
19 extensive lists, as will be described hereinafter.

20

21 As described above, the system provides the user through  
22 their interface device and a linked host computer facility,  
23 transparently connectivity to multiple remote proprietary  
24 databases for retrieving necessary data such as drug and  
25 condition lists.

26

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1 Pressing (or clicking on) highlighted fields beneath the  
2 headers in prescribing header bar 84, in most cases,  
3 activates pull-down menus, or data entry scrolls. Generic  
4 field 90 is merely a toggled flag while **Expires** field 104 is  
5 a system-calculated field. Although provision can be made  
6 for a physician to make original entries, the preferred  
7 embodiment provides a comprehensive selection of system-  
8 generated drug prescribing data from which the user may make  
9 selections.

10

11 If the user knows the drug they wish to prescribe, the drug  
12 name may be keyed in or, preferably selected by highlighting  
13 and clicking from one or more intelligently maintained lists  
14 presented in drop-down menus to post it to the respective  
15 highlighted field under **Drug** header 88. Alternatively, the  
16 user can select a condition from a condition list and make a  
17 drug selection appropriate to that condition from a drug  
18 selection screen such as those shown in Figures 4 through 11  
19 as will shortly be described in more detail.

20

21 Generic flag 90 is a simple yes/no indicator which is linked  
22 to each drug selection to approve generic drug substitution  
23 for brand name drugs by the pharmacist, if such substitution  
24 is permitted by state regulation.

25

26 **Prescription quantification**

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1 The **Form, Size, Route** and **Amounts** headers 92-98 are linked  
2 to the drug selected and bring system resources to bear to  
3 enable a prescriber rapidly to quantify the prescription  
4 with appropriate dosages that can be filled at a pharmacy,  
5 without undue difficulty. Activating any one of the fields  
6 under headers 92-98 drops down a menu, which menus together  
7 offer a selection of all known formulations of the drug  
8 selected, as provided by the manufacturer, using  
9 comprehensive drug inventory data accessed via the host  
10 computer facility or its supporting data-retrieval networks.  
11

12 The entry for **Form** field 92 may be selected from choices  
13 such as capsule, caplet, tablet, and liquid. That for **Size**  
14 field 94 might be a selection of 50 mg, 100 mg, and 200 mg  
15 and the **Route** field 96 selections might be "PO" for per  
16 oral, by mouth, "PR" per rectum, "IV" for intravenous, and  
17 so on. The displays are related and intelligently selected  
18 to display relevant options. Thus, for example, if "PO" is  
19 selected as the route of administration, only PO dosage  
20 forms are displayed. On the other hand, if PO oral forms  
21 are selected, "PO" appears as the route of administration.  
22

23 The **Amt** field 98 is the amount or quantity of drug to be  
24 dispensed in the prescription, for example 30, 50 or 100  
25 capsules or 50, 55, or 100 ml of liquid. **Refill** field 100  
26 shows the number of times refilling is permitted and **Dosing**

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1 field 102 has two columns, one being a numeric designation  
2 of a number of tablets, caplets or liquid dosages to be  
3 taken at any one time and the other being an alpha  
4 indication of the dosing frequency such as QD for daily.  
5

6 In an optional, modified embodiment of the invention (not  
7 shown), the system can calculate or suggest effective  
8 dosages for a selected drug, or a narrow range of effective  
9 dosages, according to dosage-relevant patient  
10 characteristics, for example, height, weight, age, sex,  
11 pregnancy and the like, taking into account the physical  
12 formulations in which the drug is known to be available.  
13 While these characteristics might be entered or selected  
14 from lists during the prescription quantification procedure,  
15 greater power is obtained by including them on the patient's  
16 record and having the system reference these characteristics  
17 each time a new drug is prescribed for that patient and make  
18 dosage recommendations according to the known behavior of  
19 the selected drug as it applies to the current patient.  
20

21  
22 Referring to the embodiment illustrated in the drawings,  
23 **Expires** field 104 can be system-calculated field from the  
24 entries in **Amount** field 98 and **Dosing** field 102, to indicate  
25 the day on which the last dose will be taken.  
26 Alternatively, the physician-user can select, or enter, an

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1 expiration date in **Expires** field 104 for example to coincide  
2 with a desired duration of treatment, or next visit, the  
3 system can back-calculate refills or the amount dispensed.  
4

5 Back-calculating prescription quantifiers is useful to  
6 coordinate multiple prescriptions to expire on the same day,  
7 for the patient's convenience and to reduce potential errors  
8 or abuses. Another valuable application of an expiration-  
9 controlled prescription is to benefit plan managers,  
10 enabling the physician, where appropriate, readily to  
11 coordinate prescription amounts to preferred schedules and  
12 programs of drug benefit plan managers, for example a  
13 ninety-day plan. Such preferred schedules can be system-  
14 offered or defaulted, if desired.  
15

16 Alternatively, if desired, means can be provided for the  
17 physician themselves to write or key in the appropriate  
18 dosage entries for a selected drug.  
19

20 In this preferred embodiment of prescription management  
21 system according to the invention, the **Drug** and **Condition**  
22 fields 88 and 86 are linked together to express the  
23 therapeutic objective of the user's prescribing decisions,  
24 or the *prescribing intent* of the prescription, as will be  
25 described in more detail with reference to Figures 4 through  
26 11.

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1 As stated above, a preferred objective of the invention is  
2 to minimize need for keyed data entry, to minimize  
3 information look-up, or preferably to avoid all need for  
4 keying, by providing a comprehensive system interfacing with  
5 the user through easily operated data entry devices such as  
6 employed in pen-based computer devices. To achieve this  
7 end, the prescription management screen of Figure 3, is  
8 preferably supported by comprehensive, fully adequate, up-  
9 to-date databases of drug information that, in a  
10 particularly preferred embodiment of the invention, provide  
11 a physician user with substantially all available relevant  
12 prescribing information on drugs, especially on those drugs  
13 they write most frequently, which may be favored with  
14 preferential device storage on the user's interface device,  
15 for rapid retrieval. Relevant prescribing information on  
16 other drugs, written less frequently, or not at all by that  
17 user is available on the network.

19 Prescription fulfillment

20 When drug specification is completed to the physician's  
21 satisfaction, **Send Rx** button 80 is pressed to output the  
22 newly created electronic prescription in any desired form  
23 such as to print, to local or remote storage or to remote  
24 file transfer as an electronic prescription. The electronic  
25 prescription can be transmitted across a network for  
26 fulfillment by any specified pharmacy, for example, the

1 patient's preferred pharmacy or a pharmacy preferred by the  
2 patient's drug benefit company for the particular patient's  
3 locality. Preferred routing options can be provided for the  
4 patient or the drug benefit plan, or both, and the system  
5 can default to appropriate options for the patient's benefit  
6 plan. Routing may be more or less complex and may for  
7 example split say a one-month prescription to provide a  
8 bridge prescription giving the patient an immediate one- or  
9 two-week supply from a local pharmacy, and sending the  
10 balance of the prescription for fulfillment by a lower cost  
11 mail order house. If desired, a Bridge Rx button (not  
12 shown) may be added to prescription creation screen 39 to  
13 perform such a prescription-splitting function.  
14

15 Patient compliance and prescription drug abuse

16 Ensuring that a patient complies with the terms of a  
17 prescribed treatment, neither neglecting nor overindulging  
18 in a prescribed drug therapy, is a serious problem in health  
19 care management. It is difficult to ensure that out-  
20 patients actually ingest the prescribed amounts of  
21 medication at the prescribed intervals. Many mistakes and  
22 abuses occur. The problem is exacerbated when a patient is  
23 prescribed a confusing multiplicity of drugs that may have  
24 to be ingested in different amounts at different times of  
25 the day. The present invention enables, and includes,  
26 unique solutions to this problem that greatly facilitate a

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1 patient's ability to comply with a simple or complex regimen  
2 of dosages, without costly skilled supervision. In  
3 addition, many types of intentional abuse can be monitored  
4 and possibly prevented.

5 One approach to enhancing patient compliance, according to  
6 the invention, employs a novel dose-scheduling drug package  
7 that is readily adaptable to accommodating and scheduling  
8 single or multiple prescription dosages to help a patient  
9 take the right dose of the right drug at the right time, and  
10 will be described in detail hereinbelow.

11  
12 Another approach is, to some extent, inherent in features of  
13 the prescription management system described herein. Where  
14 multiple physicians accessed by a patient utilize the system  
15 described herein, with common online access to, and assembly  
16 of, a patient's prescription history record whereby that  
17 record provides a current record of new prescriptions, then  
18 a common abuse can be controlled wherein a patient presents  
19 a problem or condition to more than one physician to obtain  
20 multiple prescriptions with a view to indulging in abusive  
21 ingestion or illicit resale. This problem is especially  
22 prevalent with analgesics. Where a physician, or perhaps  
23 pharmacist, if the patient's prescription history is  
24 available to the pharmacist, sees a similar current prior  
25 prescription has been issued, they can refuse to duplicate  
26 it.

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1 Clearly, regulatory authorities wishing to control such  
2 abuses can further that goal by encouraging widespread, or  
3 universal, deployment of the prescription management system  
4 of the invention. Where the system also provides, for  
5 example in the patient's history record, notification from a  
6 pharmacy, or from a drug benefit plan linked to the  
7 pharmacy, of fulfillment of a prescription, and that  
8 information is available to the prescriber, for example from  
9 the patients' history record, another common abuse wherein a  
10 patient pleads loss of a prescription to obtain a duplicate,  
11 can also be prevented.

12  
13 Bringing fulfillment information from the pharmacy to the  
14 point of care via the patient's record or other convenient  
15 reporting medium, with or without the intermediary of a drug  
16 benefit company linked as a remote source database, can  
17 provide not only a valuable prescription abuse monitoring  
18 parameter but can also be used to enhance compliance with  
19 the prescribed treatment, especially if coupled with an  
20 alerting system.

21  
22 For example, the system may alert a prescriber that the  
23 intended expiration date of a critical prescription has  
24 passed without the prescription having been filled. The  
25 prescriber thus becomes aware that the patient has gone off  
26 the medication and can take steps to contact the patient and

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1 alert them to the dangers or problems that may arise.  
2 Alternatively, routine alerts can be passed to  
3 administrative personnel associated with the prescribing  
4 health care provider, notifying them of any unfilled  
5 prescription after a prespecified period of say two weeks or  
6 a month, or prescription expiration, or a shorter period for  
7 more critical medications.

8

9 Scheduled dosage drug pack

10 A particular benefit the system provides when a patient has  
11 multiple simultaneous prescriptions is an ability to print  
12 out a dosing schedule or better still, to generate a  
13 scheduled dosage multi-drug package from the electronic  
14 prescription, for example as shown in Figure 15. Because  
15 the system knows dosage, dosage frequency and the duration  
16 of all prescriptions, it can report out what pills should be  
17 taken at different times of the day to comply with the  
18 requirements of multiple medications. The information used  
19 for such a further report can drive the dispensing of the  
20 drugs of a multi-drug prescription into a novel package  
21 which has multiple labeled or coded compartments for each of  
22 a number of dosing intervals.

23

24 Figure 15 shows a scheduled dosage drug pack 182 configured  
25 as a daily pack with the day of the week prominent and the  
26 date, patient and doctor identified. Across pack 182 run

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20

21 Clearly, modified drug packs 182 embodying the principles of  
22 that shown in Figure 15 could be configured for more (or  
23 fewer) doses or drugs or for different calendar periods, for  
24 example weekly or monthly packs rather than daily. Nor is  
25 the card configuration essential, for example, a multi-drug  
26 container could be in strip or roll or book form, or metal

1 foil sheets, with tear or press-out compartments. Dosing  
2 errors are common with patients with multiple prescriptions,  
3 especially the elderly. There can for example be difficulty  
4 in knowing whether a dose has been taken or not. Drug pack  
5 182 solves these problems in a simple inexpensive manner  
6 that is prescription controlled to organize multiple doses  
7 correctly and can be easily followed by most patients.  
8 Individual sealing of doses is hygienic and child- or  
9 overdose-resistant. Daily or weekly cards could be  
10 connected together by hinges to make compact concertina or  
11 book-like packs supplying a week or a month's prescribed  
12 drug requirements.

13  
14 Variations on the theme of a scheduled dosage package will  
15 be apparent to those skilled in the art. If desired, the  
16 package could be standardized as to the number of dosage  
17 compartments, providing for example, a compartment for every  
18 hour, with those compartments lying between desired dosage  
19 times being obviously blank or never filled. A valuable  
20 feature of such packaging, which could be embodied in a  
21 single prescription package, is that by giving the  
22 physician-prescriber some physical control over the  
23 circumstances that exist when a patient is supplied with  
24 drug therapy for remote administration, the prescriber gains  
25 the freedom to adopt time-related dosage variations during  
26 the course of therapy, without confusing the patient. In a

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1 simple example, scheduled packaging might provide one pill  
2 in the morning, one at lunch time, and two at night, in an  
3 attempt to maintain blood drug levels through the night.  
4

5 Other regimens could provide higher initial dosages to build  
6 up blood drug levels, followed by lower maintenance dosages.

7 In any such case, the patient simply takes, or is  
8 administered, at any given time, whatever dosage or dosages

9 have been packaged into the bay 184 that is appropriately  
10 identified by patient, time and date. More subtle or more

11 complex regimens will be apparent to those skilled in the  
12 art, for example one drug might be discontinued, and

13 possibly resumed after a suitable interval, while another  
14 continues. Another useful technique to be able to

15 administer via the dosage-scheduling package described  
16 herein is to taper down one drug while beginning to

17 administer another, to provide a graduated switchover.

18 Changing anticonvulsant therapies from one drug to another  
19 is an example of where this technique may be useful.  
20

21 Prescriber-controlled dosage scheduling can be included in  
22 the system via an additional window or screen, offering the  
23 prescriber selection of the relevant variables, such as

24 time-related dosages, with defaults or preferred selections  
25 for what can be system-determined as the most probable or

26 most beneficial choices for the patient being treated, or

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1 accord with the patient's formulary's preferences or with  
2 the particular prescriber's preferences, pursuant to the  
3 principles described herein. Specific tapering or starting  
4 protocols can easily be implemented for outpatients  
5 decreasing the requirement for costly skilled supervision.  
6

7 Dosing Indicator Device

8 For more needy patients, the time- and date-scheduled drug  
9 packaging described herein can be rendered electronically or  
10 electro-optically readable, for example with bar-coding or  
11 by using transparent compartments, to cooperate with a novel  
12 dosing indicator device that a patient could take with them  
13 to their home or on their travels. Such a novel dosing  
14 indicator device, as contemplated herein, includes a time-  
15 and-date clock and is designed to receive at least one  
16 scheduled dosage package, as described herein, and to  
17 inspect that package to determine what drug pills, capsules  
18 or the like have been removed. In the event that a pill or  
19 the like is detected in any bay stamped with a date and time  
20 prior to the date and time clocked by the device, an audible  
21 or visual or remote alert, or a combined alert, is  
22 triggered. Inspection sensing is preferably electro-optical  
23 and targets individual compartments with a light beam that  
24 is reflected or diffused by an individual pill or associated  
25 light-modulating tag, or by a bar code stamp or label which  
26 is required to be removed with each dosage of any drug. The

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1 device can include a movable scanner that advances in  
2 relation to a package from one bay 184 to the next, scanning  
3 relevant compartments in the bay, as time passes, or it can  
4 comprise an array of photoelectric sensors registering with  
5 individual compartments of the package, which are  
6 electronically controlled and read in turn, as time passes.  
7 Equivalent sensing systems will be apparent to those skilled  
8 in the art.

9

10 A preferred embodiment of dosing indicator device  
11 accommodates, within an aesthetically pleasing housing, a  
12 multi-bay scheduled dosage package, a time-and-date clock, a  
13 time-related sensor to detect the presence of a drug dosage  
14 in the bays one or more alerting systems, associated  
15 electronics which may include a microprocessor, and a power  
16 supply, for example, a battery, ac connector or remote  
17 drawdown source, or the like.

18

19 Such a dosing indicator device can be embodied as a motor-  
20 driven single- or multi-drug dosage dispenser which, for  
21 example, can house a tape, or strip-like and preferably  
22 rolled, scheduled dosage package, having a time line along  
23 the roll, and advances individual bays 184 containing one or  
24 more dosages for a given dosage time, and presents a single  
25 bay 184 (containing one or more dosages) for external  
26 delivery and removal (for example by tearing) by the

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1 patient, or patient's aid, in timed relationship to the  
2 dosage time (a half hour before, perhaps) and triggers one  
3 or more alerts if the bay 184 is not removed (a half hour  
4 after, perhaps).

5

6 Preferably, each bay is accompanied by written information  
7 as to the patient, time and date, each drug, and any  
8 relevant dosing instructions. The individual compartments  
9 of such a removable bay cannot readily be sensed for the  
10 presence of individual pills. Clearly a sensor is required  
11 for the presence of an externally exposed bay. The system  
12 assumes that the pills in a removed bay will be ingested,  
13 but this assumption may be wrong on occasion. More rigorous  
14 patient compliance may be exacted by including in, or in  
15 association with the device, a receptacle for an emptied bay  
16 184 and triggering alert means if such emptied bay is not  
17 received within a specified time interval. Emptied bays can  
18 be retained within the receptacle. To deter deceit of the  
19 receptacle it can read a time and date stamp, or other  
20 unique identifier on bay 184.

21

22 A multipatient version of the drug dosage dispenser  
23 described herein can also be provided for inpatient use in  
24 medical or health care facilities, especially hospitals and  
25 clinics. Such a multipatient version could comprise a  
26 central dispensing station, located for example at a nurse's

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1 station. The dispensing station can have multiple ports,  
2 preferably identified with bed locations and bed-occupants'  
3 names, whereby scheduled drug dosages for each bed-occupant  
4 patient are dispensed at scheduled dosage intervals, if  
5 desired with appropriate alerts or indicators. Nursing or  
6 other staff can readily remove and administer the correct  
7 drug dosages for multiple patients, possibly on a single  
8 round, or at specific times of the day.

9  
10 Drug contraindications

11 A further valuable feature of the novel prescription  
12 management system described herein is an ability to review a  
13 completed prescription for contraindications, or relative  
14 contraindications, such as patient allergies to the  
15 prescribed drug and such as possible drug-to-drug  
16 interactions with other drugs the patient has previously  
17 been prescribed. Contraindications may be clear-cut, for  
18 example, penicillin *must not* be selected for penicillin-  
19 allergic patients, whereas relative contraindications are  
20 less decisive and may be overridden by the prescriber in  
21 appropriate circumstances, for example an NSAID (non-  
22 steroidal anti-inflammatory drug) may be a preferred choice,  
23 in the prescriber's judgment for a patient with peptic ulcer  
24 disease, in spite of the attendant <sup>risks</sup> ~~risk of~~ 22

25  
26 The system can also screen or review for other possible

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1 unintended adverse outcomes to the prescribed therapy, or  
2 for special precautions regarding a prescribed drug's use.  
3

4 Preferably, the system alerts the physician-user at the  
5 point-of-care if they prescribe an offending agent, and  
6 provides an alert and an opportunity to amend the  
7 prescription before dispatching it for fulfillment.

8 Processing to screen for interactions may occur on the  
9 user's point-of-care device or on the host computer facility  
10 or remote computer system, or may be delegated elsewhere by  
11 the host computer facility, and reported back to the  
12 physician, online as an integral function of the  
13 prescription process. Alternatively, interaction screening  
14 may be run on pharmacy-related systems, and notification of  
15 problems can be sent immediately to the user's point-of-care  
16 device using e-mail or using procedures within the  
17 prescription management application of the invention.  
18

19 An allergies review can be conducted by checking system-  
20 stored known allergies of patient Mary Harrington against  
21 known pharmacokinetics and pharmacodynamics of the newly  
22 prescribed drug, entered in prescribing zone 44, for any of  
23 those allergies. Mary Harrington's allergy information is  
24 preferably an adjunct to her patient record and is  
25 downloaded to the user device from <sup>the</sup> host computer facility  
26 when Mary Harrington is selected from the patient selection

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1 screen of Figure 2. Drug allergenic proclivities are also  
2 downloaded from one or another remote database employing the  
3 host computer facility, under supervision of the inventive  
4 prescription management system, but preferably at a later  
5 point in the procedure, such as when a particular drug is  
6 selected for posting to prescribing zone 44.

7

8 Alternatively, the requisite information can be downloaded  
9 when the allergy review is conducted. Such allergy  
10 screening can alternatively be effected when a new drug is  
11 posted to Drug field 88. Either way, a positive system  
12 finding, indicating a risk of allergic reaction to the newly  
13 selected drug can activate a visual indicator or warning,  
14 for example, Allergies button 52 may blink and, if desired,  
15 an audible warning may sound alerting the physician to  
16 reconsider their selection. Alternatively, or additionally,  
17 an alert screen can tell the physician of an allergy if an  
18 attempt is made to prescribe an offending drug. Such alerts  
19 can be used to notify the physician of drug interactions,  
20 treatment warnings or can alert them to non-compliance with  
21 formulary recommendations, for example to the use of an  
22 unnecessarily expensive drug, and may be accompanied by  
23 suggestions for more appropriate alternative therapies.  
24  
25 Equivalent procedures can alert to possible drug  
26 interactions and contraindications, referring to the

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1 patient's prescription history for possible active or  
2 recently expired prescriptions that may interact with a  
3 newly prescribed drug, and for other patient data relevant  
4 to the drug's behavior in that patient. Alternatively, ~~the~~  
5 such a review for possible undesired aspects of the drug's  
6 performance on the patient is made upon activating Send Rx  
7 button 80.

8

9 Electronic prescription transmission

10 Activation of Send Rx button 80 can provide a drop-down menu  
11 of choices including "Send this prescription" and "Add  
12 prescriptions prior to sending in a batch".

13

14 A preferred embodiment of the invention includes a  
15 capability whereby a completed prescription is transmitted  
16 across one or more data networks for fulfillment and record  
17 updating in a wired or more conveniently, for mobile  
18 professionals, a wireless broadcast. Preferably, where new  
19 information is generated in the prescription creation  
20 process, relevant remote source databases (which may be  
21 proprietary) are updated with appropriate components of the  
22 new information and such updates are effected with proper  
23 controls to ensure data integrity, confidentiality and  
24 authenticity. Using the system as described herein, all  
25 transactions generate an audit trail and are authorized or  
26 preauthorized by the patient.

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1 Because of the currently substantial cost of air time, batch  
2 transmission is highly desirable. Accordingly, system  
3 defaults encourage the physician to elect batch transmission  
4 of multiple prescriptions for an individual patient,  
5 although in keeping with the principle of not imposing  
6 constraints on a physician, the system does not mandate such  
7 batch transmission. Executing a "Send Prescription"  
8 function outputs the prescription for fulfillment in any  
9 desired form, posts the completed new prescription to the  
10 prescription History zone 43 in the center of the screen,  
11 and outputs the new prescription from the user's station to  
12 update a control system or remote database, as desired.  
13 Prescriptions can be electronically transmitted to a  
14 pharmacy or pharmacy-management system for fulfillment, or  
15 printed on paper for paper-based fulfillment by hand  
16 delivery or fax.

17

18 The inventive prescription management system embodiment  
19 disclosed herein is designed flexibly to facilitate a  
20 physician's prescribing activities, to place helpful  
21 information at their fingertips and reduce manual look-up  
22 chores, while avoiding any authoritarian direction, mandate  
23 or constraint upon a physician's professional activities or  
24 judgement. Thus, while the system may attempt to provide  
25 intelligent options and exhaustive selection lists, options  
26 such as "other" are always available to permit the

1 prescriber complete freedom of choice, whether or not their  
2 choice is known to system-available databases.

3

4 Optional system enhancements provide for enrichment of  
5 external communications, for example prescriptions and e-  
6 mail with what may be termed "electronic ink" messages  
7 generated at the user device. "Electronic ink" refers to  
8 notes or messages appended to external communications, or  
9 transactions in the form of free text or voice annotations  
10 for non-structured instructions, and the like. Voice  
11 annotation is particularly convenient, as well as possibly  
12 constituting unique user-identification and some currently  
13 available low form factor user devices incorporate a  
14 microphone, facilitating voice annotation.

15

16 Toward the end of prescribing flexibility, to avoid being  
17 second-guessed by physician users, and to command their  
18 respect and loyalty, the system should have access to, and  
19 provide to its users fully comprehensive drug and patient  
20 information so far as this is available. Comprehensive,  
21 accurate and complete drug and patient information are  
22 equally important for effective prescribing. It follows  
23 that the drug and patient information source databases from  
24 which the prescription management system draws, must be  
25 maintained up to date, by appropriate network services.

26

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1 It is the normal, challenging nature of highly qualified  
2 professionals that those with the latest news, such as new  
3 drug releases and approvals, will want immediately to test  
4 the system for currency with the news.

5

6 The unique source-oriented information retrieval and  
7 updating system described herein provides preferred means  
8 for supporting the prescription management system of this  
9 invention with an adequate infra-structure of data-retrieval  
10 networks supplying a comprehensive array of up-to-date  
11 prescribing information and patient-related data to the  
12 point-of-care. Other suitable information data retrieval  
13 and updating systems will be apparent to those skilled in  
14 the art and can be linked to the system of the present  
15 invention to provide allergy and interaction alerts,  
16 formulary changes, new drug approvals, and to lock out or  
17 warn against, the prescribing of inappropriate or recalled  
18 drugs.

19

20 Drug and condition selection

21 Novel drug selection methods pursuant to the invention will  
22 now be described with reference to Figures 4 to 11. The  
23 condition list selection screen shown in Figure 4 appears  
24 upon activation of Condition field 86 in the prescription  
25 management screen of Figure 3, to enable a prescriber to  
26 approach selection of a treatment drug by first specifying a

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1 diagnosed condition. Alternatively, a drug may be directly  
2 specified by drug name<sup>(15-30)</sup> by activating Drug field 88, as will  
3 be described in connection with Figure 9, after which the  
4 prescriber selects a condition to specify the purpose of the  
5 therapy. Such condition or drug selection screens can be  
6 opened by similar condition or drug buttons in any other  
7 relevant screen or application, for instance in a patient  
8 encounter screen where the drug selection routines now to be  
9 described with reference to Figures 4 to 11 can be used to  
10 assist a physician to select or review treatment objectives  
11 in a computer-assisted patient encounter.

#### 13 Condition list selection

14 The condition list-selection screen of Figure 4, provides a  
15 preliminary selection of a suitable condition list from  
16 which a physician user can work to select a drug. As shown,  
17 the screen comprises a **Select Condition List** title 110 and a  
18 **Condition List** display header 112 beneath which the names of  
19 **Condition Lists** 114 are grouped in a left-hand column. A  
20 right-hand column beneath header 112 displays the conditions  
21 116 of whichever condition list 114 is highlighted, or  
22 otherwise selected. In this case the user's personal  
23 condition list 114 has been highlighted and may be seen to  
24 comprise a short list of commonly occurring problems that,  
25 for example, a general practitioner might encounter.

1 Multiple different **Condition Lists 114** are available in this  
2 embodiment to provide a range of choices to physicians, and  
3 six are shown, by way of example. Three of these lists 114  
4 classify conditions broadly by diagnosis (Dx) and comprise a  
5 system-maintained **Dx-Personal list 114**, an alphabetically  
6 organized **Dx-Alphabetic list 114** of all conditions in the  
7 system and a **Dx-Category list 114**. **Dx-Category list 114**  
8 lists conditions by broad therapeutic category such as  
9 cardiovascular, GI or dermatology. A fourth condition,  
10 problem or diagnosis list, **Dx-Patient list 114** lists  
11 previously exhibited conditions or problems of the selected  
12 patient, in this case, Mary Harrington. **Dx-Patient list 114**  
13 is system maintained (and manually supplementable) and  
14 changes according to the patient selected in the patient-  
15 selection screen of Figure 2. **Dx-Personal list 114** is also  
16 system maintained (and manually supplementable) and changes  
17 according to which prescriber signs on.

18  
19 Preferably, the system includes frequency counters to track  
20 the conditions the user encounters with time, and the counts  
21 obtained are used automatically to maintain or generate a  
22 **Dx-Personal list 114** for the user, which more closely  
23 portrays patterns of conditions encountered in the user's  
24 practice as time goes by. Base periods for reporting usage  
25 may be varied, or user selected, to list conditions  
26 encountered by frequency in, for example, the last year, the

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1 last five years, or perhaps, the last three months. Also, a  
2 default can be included to highlight a selected patient's  
3 last active condition or conditions as a first-line choice.  
4

5 Preferably, any time a new diagnosis is made, the new  
6 condition encountered is placed in the user's **Dx-Personal**  
7 list 114 and any time a drug is chosen it is placed in a  
8 personal drug list for the user. The first time either a  
9 condition or a drug is selected, it is added to a user  
10 profile stored on the network, for example, at the host  
11 computer facility.  
12

13 In addition, a physician-user can manually maintain one or  
14 more custom lists, **Dx-Custom 1** list 114 and **Dx-Custom 2** list  
15 114, for their own preferred short lists of conditions  
16 being, for example, conditions appropriate to their  
17 specialty that the individual physician frequently  
18 encounters for treatment. Alternatively, libraries of  
19 specialty lists may be made available from which the user  
20 selects one or two lists for their personal use. Such  
21 custom lists 114 may be associated with different user  
22 activities, for example, **Dx-Custom 1** could be used at a  
23 hospital where the user is an attending physician, while **Dx-**  
24 **Custom 2** is used at a pain clinic where the user is a  
25 visiting physician. The various condition lists 114  
26 provide alternative pathways to drug selection that a

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8

9 The condition list selection screen shown in Figure 4 is a  
10 gateway to other condition and drug selection screens. As  
11 an alternative for quicker selection, a preferred condition  
12 list (typically a Dx-Personal list 114) could be set as a  
13 default with other condition lists 114 being reached via a  
14 Change Condition List button (not shown).

24

25 Condition selection

26 In the **Select Condition** screen of Figure 5, the patient

condition 116 in the Dx Personal category shown comprise generalized groups of disease, some serious like diabetes and pneumonia, and others less so, for example rhinitis or sinusitis. More complex embodiments than the one shown here may categorize conditions into as many as four or five different columns of subcategories of condition according to disease pathology, therapy, personal knowledge and so on. Such condition categorization, as a preliminary to drug listing, provides a very powerful tool for physicians to view their prescribing options on screen and to organize them. Organization of drugs by lists of effectively treated patient conditions enables a user intelligently to access a large body of drug data selections. This approach provides multiple mapping so that the user can find a suitable drug or selection of drugs via different pathways according to their preferred work methods.

Different pathways to a drug via conditions organized in other ways, notably by body system, are illustrated in Figure 8, described hereinbelow. Direct pathways of drug selection using drug lists are illustrated with reference to Figures 9 and 10, described hereinbelow.

In the example shown in Figure 5, the user-physician has highlighted and selected a patient condition 116, namely, peptic ulcer disease (PUD)/gastritis, displaying, in the

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1 next right-hand column (see Figure 6), a short, system-  
2 generated list of drugs known to be therapeutically  
3 indicated for PUD/Gastritis and which may be suitable for  
4 prescription or to have been prescribed in the past by that  
5 user for treating these conditions. The presence of the  
6 user's previously prescribed drugs, which may not  
7 necessarily appear on third parties' lists, helps  
8 personalize the list to the user.

9  
10 Referring to Figure 6, now that a condition, PUD/Gastritis,  
11 has been selected, a new screen title, **Select Drug 111**,  
12 appears and selection of a drug to treat this condition  
13 proceeds. To aid the selection, a condition-specific,  
14 formulary drug list 118 is displayed in the next right-hand  
15 column of the **Select Condition** screen of Figure 6 under  
16 **Formulary Drug** header 120. Alternatively, a physician's  
17 personal list of drugs may be displayed with formulary drugs  
18 highlighted. If desired, relative cost information can be  
19 included or alternative drugs may be ranked by preference of  
20 the formulary manager.

21  
22 Formulary Drugs are those listed by a drug formulary  
23 specified by, or relevant to, the patient, in this case,  
24 Mary Harrington. The drug formulary may be generated by a  
25 prescription benefits management company and is a key  
26 ingredient in a system for reducing overall prescription

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3

19

26

1 data-retrieval network, each time it is required, in  
2 accordance with preferred embodiments of the invention, from  
3 a remote source database, updates are automatically posted  
4 across the network.

5  
6 Nonformulary drugs may be substantially more expensive than  
7 formulary drugs, or may not be covered by the patient's drug  
8 benefits plan, and may require out-of-pocket payments by the  
9 patient which circumstance may cause administrative problems  
10 to the physician and be a burden to the patient. Worse  
11 still, the patient may not have the prescription filled.

12  
13 By including pharmacy-derived prescription fulfillment  
14 information, a patient prescription history can indicate  
15 whether a patient actually received a medication. The  
16 physician can be alerted (by e-mail) if a patient has not  
17 filled a prescription for a critical medication, for example  
18 LASIX (Hoechst), prescribed for hypertension, enabling a  
19 follow-up with the patient to be initiated.

20  
21 Where formulary drugs are professionally acceptable to the  
22 physician and of equivalent therapeutic effect to non-  
23 formulary drugs, failure to use them is clearly undesirable.  
24 This problem is overcome by the present invention. If the  
25 physician is satisfied with the formulary drugs offered by  
26 the prescription management system of this embodiment,

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1 anyone may be selected and automatically posted to the novel  
2 prescription described herein as will be described.

3

4 Prescribing non-formulary drugs

5 Should the physician know, for example, that cimetidine and  
6 ranitidine, drugs in a similar class, have been tried and  
7 found ineffective and that the condition is well beyond  
8 these first line treatments, so that none of the formulary  
9 drugs is suitable, then the physician can select **Other**,  
10 which selection displays a nonformulary drug list 122, under  
11 nonformulating drug header 124, as shown in Figure 7. In  
12 this case, the physician selects **Sucralfate** as being a non-  
13 formulary drug in a different chemical category and having  
14 somewhat different therapeutic properties from those  
15 previously applied to treatment of this patient's symptoms.

16

17 Having made the decision to select Sucralfate, the physician  
18 is informed by the system display shown in Figure 7 that  
19 sucralfate is a nonformulary drug not on patient Mary  
20 Harrington's prescription benefit management company's  
21 schedule. With this timely notification in hand, the doctor  
22 can, if appropriate, consult with a patient, explain the  
23 reasons for his or her drug selection and gain the patient's  
24 agreement to assuming the cost of the prescription, or  
25 obtain authorization from the plan to cover the cost of this  
26 prescription for this exceptional case. Physicians

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1 manifesting increasing compliance flowing from use of a  
2 prescription management system according to this invention  
3 can expect ready approval of a non-formulary drug on a  
4 justified exceptional basis.

5

6 By tying a diagnosed condition to a prescribed drug and  
7 requiring a condition to be recorded as a treatment  
8 objective before a prescription is fulfilled, new drug  
9 formularies can be created where prescribing of a drug is  
10 qualified according to the condition treated. For example,  
11 an expensive drug like captopril may be a first-line  
12 formulary choice for an acute condition such as congestive  
13 heart failure, but not a first-line choice, or may even be  
14 excluded as non-formulary, if prescribed for a chronic  
15 condition such as hypertension.

16

17 In practice, after the system learns the user's preferences,  
18 most condition and drug selections will be quickly made from  
19 the user's preferred or custom lists or from historically  
20 derived patient lists of previously encountered conditions,  
21 or previously prescribed drugs. The system adapts to the  
22 prescribing user to enable rapid creation of routine  
23 prescriptions. A minority of situations may call for less  
24 obvious therapies or therapies with which the physician has  
25 little or no experience. Physicians tend to be most  
26 reluctant to prescribe new drugs. Responsible physicians

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1 will usually scrutinize a great deal of relevant information  
2 before prescribing a drug for the first time. This effort  
3 is captured by the system which enables a prescriber to have  
4 quick access to their prior experience and confine their  
5 drug selections to drugs they have used previously and which  
6 were satisfactory. (A physician can of course edit their  
7 personal list to remove drugs that proved unsatisfactory for  
8 some reason or another, whether therapeutic or not, or they  
9 can be removed automatically based on decreasing frequency  
10 of use.)  
11

12 In other circumstances a physician will need to select a  
13 drug with which they have little or no experience. Here,  
14 when it is most needed, the system provides major support  
15 and reassurance, presenting several different pathways to  
16 appropriate solutions enabling online access to the latest  
17 available scientific, clinical and commercial information  
18 about a new drug as well as screening for complications.  
19 The ability to offer drug detailing at the point of need for  
20 new drug information can be used to attract revenue from  
21 pharmaceutical companies, managed care companies or others,  
22 and is especially useful in decreasing the barriers to  
23 switching to first-time use of a drug. The system-provided  
24 prescribing information resources that are brought to the  
25 point of care are also valuable in enabling a physician to  
26 make quick therapeutic substitutions.

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1 The drug selection screen shown in Figure 8 offers, by way  
2 of example, one route to selecting a new drug not on the  
3 prescriber's short lists. Here, selection is condition  
4 driven and proceeds with the selection of a condition list  
5 114, **Dx by Body System** or **Dx by Therapeutic Class**, and then  
6 locating a drug to treat that condition; or alternatively,  
7 by directly selecting a drug via drug lists 115 **Rx by**  
8 **Therapeutic Class** or **Rx by Alpha**. Displayed in Figure 8,  
9 reading across the columns from left to right, are a list of  
10 body systems 117 from which the prescriber has selected  
11 **Musculo-skeletal**. In the next right column the system  
12 displays a list of conditions 116 that might be displayed by  
13 the musculo-skeletal system, of which nine are listed by way  
14 of illustration. From these nine the prescriber has  
15 selected **Osteoarthritis**. Osteoarthritis is posted to  
16 **Condition** field 86 in prescribing zone 44 of prescription  
17 creation screen 39 (Figure 3).

18  
19 With a condition specified, selection proceeds to the  
20 choosing of a drug to treat the condition of osteoarthritis.  
21 Drug selection proceeds through a preliminary selection of  
22 drug category, from a list of drug categories 119 in the  
23 next column to the right, enabling the prescriber to choose  
24 their therapeutic approach, in this case, as between  
25 employing an analgesic, a narcotic, a NSAID (non-steroidal  
26 anti-inflammatory drug) or a salicylate. A NSAID is chosen,

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1 generating an extensive list of drugs 121 in the right most  
2 column in Figure 8, from which the prescriber can make their  
3 final selection which will be posted to Drug field 88 in the  
4 prescription creation screen 39 (Fig. 3).  
5

6 The complexity of the prescribing process is graphically  
7 illustrated in Figure 8. Even after narrowing the field  
8 down to a specific class of drugs, NSAIDS, for treating a  
9 particular symptom, osteoarthritis, there are still of the  
10 order of fifty drugs from which the prescriber makes a final  
11 selection.  
12  
13

#### 14 Direct drug selection

15 Prescribers often know what drug they want to prescribe and  
16 will wish to access it very quickly, and may not use the  
17 system if they are unable to do so. This goal can be  
18 reached with user-adaptive personal drug lists organized to  
19 default to a prescriber's preferred choices, as described  
20 herein.  
21

22 One preferred user-adaptive approach to providing a quick-  
23 prescribing pathway to a prescription is for the system to  
24 process the user's personal drug list, to highlight, or  
25 short-list or otherwise present those drugs on the personal  
26 list that are appropriate therapy for any of the patient's

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1 active conditions, and preferably also, that are on the  
2 patient's formulary.

3

4 Referring to Figure 9, an alternative direct drug-  
5 specification pathway commences, reading from left to right,  
6 with selection of drug list 115 Rx by Therapeutic Class.

7 From a list of perhaps fifty to one hundred drug categories  
8 119 which appears in the next right hand column, the  
9 prescriber has picked Diuretics, generating an even longer  
10 list of diuretic drugs 121 from which the prescriber has  
11 picked Dyazide (trademark, Smith Kline Beecham). The system  
12 now calls for entry of a condition, in this case  
13 "hypertension". The extent of the lists of drug categories  
14 119 and diuretics 121, again illustrates the bewildering  
15 array of drug selections with which a prescriber is  
16 confronted. An otherwise uncertain or overly conservative  
17 decision-making process can be rendered efficient, reliable  
18 and manageable by a prescription management system according  
19 to the invention.

20

21 The selection program illustrated in Figure 10 provides a  
22 variety of pathways for direct drug selection via five drug  
23 lists 115, a personal, an alphabetic, a category list and  
24 two custom lists, analogous to condition lists 114. Here  
25 the user has selected Rx-Alphabetic list 115 and the system  
26 has displayed a portion of a long, scrollable list of drugs

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1 121 in the next column. This approach can quickly locate a  
2 target drug when the physician knows it by name. Here  
3 **Cefixime** has been selected and the system calls for, and  
4 requires, the prescriber to enter a condition before  
5 proceeding to quantification of the prescription. In the  
6 next column the system lists conditions that the user has  
7 previously treated with Cefixime, highlighting the most  
8 recent condition so treated, or the system may display a  
9 previous condition of this patient that was treated with  
10 cefixime, not necessarily by the current user. If the  
11 physician wishes to attack some other condition with  
12 cefixime, such other condition may be selected from the last  
13 righthand column, activated by "other".

14 The diversity of conditions treatable with cefixime  
15 illustrates the potential for outcome studies based upon  
16 widespread use of systems according to the invention to  
17 refine definitions of the therapeutic scope of individual  
18 therapeutic agents by collecting data on effective new  
19 applications and on precautions, interactions and side  
20 effects.

21  
22 **Some advantages of condition-specified drug prescribing**

23 Being abundantly served at the point of care with relevant  
24 prescribing information at the critical moment of decision,  
25 the physician can eliminate many subsequent problems or  
26 difficulties which may lead to unnecessary paperwork, or

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1 surprised, annoyed or non-compliant patients, and to  
2 unnecessary phone calls between pharmacist and physician  
3 when a patient learns only at the pharmacy that their  
4 prescription is non-formulary. The system can eliminate  
5 much unnecessary "phone tag" between pharmacies and  
6 physicians. Improved physician and patient compliance with  
7 preferred guidelines will reduce the cost of care and  
8 increase the quality of care.

9 *ab*  
10 The availability, by means of the invention, of vital drug  
11 selection information, categorized by therapeutic condition  
12 and denoted as formulary or not, *for the patient in*  
13 *question*, rapidly assembled, preferably from remote source  
14 data, and conveniently presented to a physician for flexible  
15 use in their own personal work flow, greatly enhances  
16 prescribing practices, fosters cost containment and eases  
17 the administrative burdens that fall on heavily prescribing  
18 physicians. It enables informed choice at the point of care  
19 leading to a decrease in adverse outcomes of therapeutic  
20 choices.

21  
22 Naturally the prescription management system of the  
23 invention can provide a variety of printed reports and other  
24 data outputs of any facet of the described operations. In  
25 some cases, these reports can be enhanced to provide  
26 entirely new products for example a dosing schedule such as

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1 that described with reference to Figure 15, and shipping  
2 schedules or split prescriptions divided according to  
3 suppliers requirements.

4  
5 Current and historical reports can, subject to the access  
6 controls described herein, be patient-specific, prescriber-  
7 specific or organization-specific and can be aggregated  
8 across various groups, pools, geographical regions,  
9 conditions, drugs, or time periods or combinations of any of  
10 the foregoing to provide a valuable data resource to health  
11 care providers, patients, managed care organizations,  
12 government agencies and others.

13  
14 Further to enhance the prescribing decision process,  
15 additional features can be included on screens such as  
16 Figure 7, for example drug pricing information, employing  
17 actual wholesale or retail pricing, or comparative pricing  
18 or on another manner of drug pricing or grouping, such as a  
19 comparative scale or price rating system, or relative  
20 pricing based on actual prescription benefit management  
21 company contracts. Such pricing information can greatly  
22 influence M.D. decision-making, improving formulary  
23 compliance and reducing overall drug costs, without  
24 restricting a physician's choices.

25  
26 A powerful optional feature of the invention is shown in

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1 exemplary fashion by the drug evaluation screen depicted in  
2 Figure 11. After a physician selects a drug from one of the  
3 screens of Figures 7 to 10, the system can optionally scan a  
4 drug preference database of preferred drug treatments for an  
5 evaluation of the merits of the selected drug in treating  
6 the condition. <sup>in general and for this selected condition</sup> The drug preference database may be remote  
7 and may be maintained, for example, by a managed care  
8 organization, HMO, or prescription benefits management  
9 company. As the Figure 11 example shows (which example  
10 employs different condition and drug selections from those  
11 used in Figures 6 and 7) one possible result of the database  
12 scan may be an on-screen report with an alert message, in  
13 header 126 advising the physician that the selected drug is  
14 "Not a first line drug" for treating the selected condition.  
15 As a helpful suggestion to the physician the system can also  
16 offer alternative drugs, from listings in the drug  
17 preference database, as being more meritorious for the  
18 treatment of the condition in question (pursuant to the  
19 maintaining benefit company's standards or, preferably, to  
20 objective literature reports).

21  
22 To this end, the drug selection evaluation <sup>b122 129</sup> screen of Figure  
23 11 comprises an explanatory box 128 elucidating header 126;  
24 an alternative drug selection menu 130; and at the bottom of  
25 the screen, three action buttons; for example, Tx Guidelines  
26 132 to access treatment information about the alternative

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1 drug highlighted in menu 130; a confirm button 134 to post  
2 the physician's original drug selection, in this case  
3 "Cefixime" and to return to prescription creation screen 39;  
4 and a cancel button 136 which returns the user to the drug-  
5 selection of Figure 7.

6

7 The treatment information available via **Tx Guidelines** button  
8 132 may include a literature reference supporting the  
9 system's finding that Cefixime is not a preferred first line  
10 agent for treatment of the selected condition, otitis media.

11 Optionally there may be a selection on a drop-down menu from  
12 the **Tx Guidelines** button 132 enabling a physician, without  
13 further effort to have a copy of such a study sent to them.

14 In a further optional embodiment, **Tx Guidelines** button 132  
15 can provide the user with an access point to full disclosure  
16 and prescribing information on the drug. Available

17 treatment guidelines information can include details of the  
18 particular conditions for which a system suggested

19 alternative drug has been found effective, adverse

20 conditions, preferred dosages and administration routes,

21 literature sources and so on. This aspect of the inventive

22 system provides a simple, nonintrusive technique for

23 bringing new drug information to physicians at a critical

24 moment of need, when creating a prescription.

25

26 Although described as a self-contained system, it will be

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1 appreciated that functions such as the identification and  
2 listing of drugs via conditions treated, and patient  
3 prescription histories will have value in other systems, for  
4 example, patient encounter management systems, and may be  
5 accessed directly from such systems via a prescribing  
6 information button.

7

8 As well as compensating for error or lack of information on  
9 the physician-user's part, the prescription review system  
10 exemplified in Figure 11 has great value as an educational  
11 tool. Physicians can be subtly trained to improve their  
12 drug selection behavior. By using the system aggressively  
13 and exploring its information resources, as they are  
14 encouraged to do by the system's prompts and alerts,  
15 physician prescribers effectively receive education and  
16 training at the point of care. Improvements in drug therapy  
17 are subtle and complex and it is often difficult, even for  
18 the most conscientious of physicians, to be abreast of  
19 developments in any more than one narrow field of medicine.  
20 It is just as difficult for purveyors of new drugs to break  
21 in to a physician's packed work schedule to educate them as  
22 to the merits of a valuable new drug.

23

24 More than one alternative drug may be offered. Also in an  
25 optional embodiment not shown, the physician user may choose  
26 to display a screen of drug information regarding the

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1 alternative drug or any other drug. After confirming a drug  
2 selection the system can review the patient's history in  
3 relation to the selected drug and alert the physician to any  
4 relevant allergies, one-on-one drug interactions or, if  
5 appropriate, multiple drug interactions.

6

7 Often, when new drug information is presented, a physician  
8 is unable to consider it, yet when the information is  
9 needed, or could be used, for example at the point-of-care,  
10 when creating a prescription, valuable new drug information  
11 may be unavailable or forgotten. This invention solves that  
12 problem by presenting new drug information in a timely  
13 manner at the moment when it is most needed and a physician  
14 is most interested in considering it, namely at the time of  
15 writing a prescription. It gives a benefit management  
16 company the opportunity to influence a physician's choice at  
17 the most influential moment, during the prescribing  
18 decision.

19

20 User-adaptive drug formulary compliance

21 Conventional formulary guidelines specify one or more  
22 substantial lists of preferred drug therapies. Many of  
23 these drugs will be unfamiliar to most prescribers who will  
24 therefore be reluctant to prescribe them. Natural  
25 professional prudence makes most physicians extremely  
26 cautious about specifying powerful agents for therapeutic

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1 goals when they have little or no prior experience with the  
2 agents but will be responsible for the outcome of the  
3 treatment.

4

5 The system of the invention can provide a novel approach to  
6 drug formulary management whereby prescriber-centric  
7 formularies can be established. By means of the system,  
8 drug formulary guidelines effectively adapt to the user's  
9 prescribing patterns or <sup>preferences</sup> can be followed effortlessly by the  
10 prescriber. This desirable prescriber-centricity can be  
11 obtained by giving priority to the prescriber's personal or  
12 custom lists or, better still if they are a subset of these,  
13 to the patient's history lists, and system-identifying  
14 patient-formulary preferences on those lists for easy final  
15 picking by the prescriber. Where the prescriber is  
16 selecting a drug providing effective therapy for a just-  
17 specified condition, the above procedure may often clearly  
18 identify a single drug meeting all requirements or may  
19 result in a short list of a very small number of drugs for  
20 final selection. Where no drug is listed as meeting all  
21 requirements, the system may so alert the user and suggest  
22 formulary drugs not on the doctor-specific lists or ask the  
23 user whether they wish to review appropriate non-formulary  
24 drugs from their personal or custom lists.

25

26

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1 Patient's prescription history

2 Figure 12 shows a prior prescription information screen  
3 which can be displayed by double clicking the prescription  
4 display line or activating RX History button 54 in a screen  
5 zone such as prescription history zone 43 of prescription  
6 creation screen 39 shown in Figure 3. The embodiment of  
7 screen shown in Figure 12 provides a simple passive  
8 information display, comprising an information box 138, a  
9 close button 140 and a scroll bar 142 for scrolling or  
10 browsing a library of prescription histories. The displayed  
11 prior prescription information in box 138 comprises, for the  
12 selected prescription, the condition for which the drug was  
13 prescribed, the drug name, date of prescription, dates of  
14 any renewals and the name, phone number and any other  
15 appropriate identification of the prescribing physician, in  
16 this case it is the user physician, and any other useful  
17 details that may not be strictly prescribing information,  
18 including appended free text, voice annotations or other  
19 electronic ink. Where an "N" indication appears in the Mine  
20 column 76 on the prescription history line in Figure 3, the  
21 name of another physician who authored the relevant  
22 prescription will appear in Figure 12.

23  
24 In addition to conveniently presenting useful historical  
25 prescription-related details, powerful optional features,  
26 for example, direct E-Mail communication with the physician

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1 whose name is displayed (or with some other physician) can  
2 be activated from the prescription information screen of  
3 Figure 12 or other suitable screen, can be included in the  
4 prescription management system of the invention. Such  
5 options enable physicians to send an inquiry to, and perhaps  
6 retrieve relevant records directly from another physician  
7 such as a previous prescriber to the patient, or a referring  
8 physician. The invention facilitates the execution of such  
9 information transports during the user-physician's encounter  
10 with their patient. The screen of Figure 12 could  
11 additionally have an **Auto Dial** button and be linked to other  
12 modes of communication to facilitate a direct connection to  
13 the physician of interest. Additional options include a  
14 display of historical dosage information and an ability to  
15 page through all prior prescriptions or all prescriptions  
16 for a given patient, a given prescriber, a given condition,  
17 a given therapeutic class, and so on, recapping some of the  
18 functionality of the Figure 3 prescription creation screen  
19 39.

20  
21 A further optional feature of the invention is shown in the  
22 patient problem or condition screen of Figure 13, openable,  
23 for example, from **Problem** button 50, Figure 3, which tracks,  
24 as indicated by the field headers 144-156 extending across  
25 the screen, a history of the patient's problems and records  
26 diagnostic determinations regarding individual problems.

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1 in particular, the system captures information regarding the  
2 date when a new problem first becomes active and when it is  
3 "deactivated". These dates are associated with the name of a  
4 physician user, and thence with a patient encounter and can  
5 be regarded as authentic diagnostic determinations capable  
6 of being substantiated from the physician's office records.  
7 Additional information screens, detailing, for example  
8 laboratory or other diagnostic data, or relevant personal  
9 patient characteristics, for example height and weight, can  
10 be linked to problems as they are with drugs.

11  
12 By processing such reliable base data, combined with  
13 historical prescription data associating a patient problem,  
14 or treatment category, or treatment objective, with a  
15 prescribed drug routine, valuable new information and  
16 outcome studies can be generated. For example, the duration  
17 of problems in relation to particular treatments can easily  
18 be calculated.

19  
20 Using the Figure 13 screen the system user, or the system,  
21 labels a problem or condition as new in New field 144;  
22 describes the nature of the problem in Problem field 146  
23 from a condition list (not shown) such as condition list 114  
24 shown in Figure 4; selects a "Y" or "N" flag in Act field  
25 148 to show the status of the condition as active or not;  
26 inserts the name of the physician adding the problem to the

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1 list in Diagnosing Physician field 150 (which the system  
2 will default to the current user); inserts the date the  
3 problem was added in Date field 152; inserts the name of the  
4 physician determining the problem is resolved or no longer  
5 active in Resolving Physician field 154; and inserts the  
6 date of resolution in Date field 156. Thus changes to the  
7 patient record are stamped with the name and date of the  
8 responsible physician to provide an audit trail. A  
9 physician identifier can be added if desired.

10

11 Problems that no longer manifest themselves to the patient  
12 or physician can be indicated as not active in Act field  
13 148. The problem list can be sorted by header selection and  
14 preferably presents active problems at the top of the list  
15 by default.

16

17 Such a system-maintained problem list provides an easy and  
18 convenient reference to the patient's history of conditions  
19 or problems and of the duration and currency of such  
20 problems and constitutes a valuable case management tool for  
21 physicians. The problem list is automatically supplemented  
22 during the prescribing process with the latest prescriber's  
23 latest observations and diagnoses, as indicated by selection  
24 of one or more conditions for posting to a new prescription.

25

A9

26 Where a patient complains of an old problem a quick

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.99

1 prescription creation routine comprises selecting the  
2 problem from the **Dx-Patient** list 114, then selecting a drug  
3 from a system-generated pick list of drugs providing  
4 appropriate therapy for that condition. The pick list is  
5 preferably drawn from the doctor's personal list and is  
6 either compliant with the patient's formulary guidelines, or  
7 indicates those guidelines, for example by inverse video,  
8 highlighting or the like, and also includes a selection of  
9 "other" to access drugs not on the prescriber's personal  
10 list. Such a quick prescription routine enables the most  
11 routine situations to be promptly handled, yet permits the  
12 physician to expand their prescribing horizons and does not  
13 merely require selection of the same drug as was used  
14 previously. Quick treatment substitutions are made possible  
15 by the system's presentation of available alternative  
16 therapies enabling the prescriber easily to see what  
17 alternatives are available and to explore those with which  
18 they are unfamiliar.

19  
20 Also the problems or conditions on this list can be  
21 automatically posted to a patient problem list 114 to appear  
22 as an additional "Dx" list in screens such as those shown in  
23 Figures 4-10, to provide quick selection or review of a  
24 patient's historical conditions. Preferably, such a **Dx-**  
25 **Patient** list 114 changes automatically when another patient  
26 is selected.

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1 As various system-using physicians, laboratories and the  
2 like encounter the patient or provide services to the  
3 patient, they become original sources for new record  
4 elements memorializing their encounter with the patient or  
5 the patient's attributes. The patient's history  
6 accumulates, and the system compiles, on demand, a  
7 cumulative virtual patient record including all newly  
8 created record elements. This current patient history  
9 record is promptly available to any authorized physician  
10 user on the network. In an ideal world, all relevant  
11 encounters are captured so that the patient's record is  
12 comprehensive or complete.

13  
14 The value to a patient's care givers, of an instantly  
15 available, comprehensive patient record cumulatively  
16 reflecting all current and recent medications and  
17 conditions, is immense. Its availability to emergency  
18 personnel may be life saving.

19  
20 The problem list screen of Figure 13 is accessed from  
21 prescription creation screen 39 (Figure 3) by pressing  
22 button 50. Selecting an OK button 158 or Cancel button  
23 160, the problem list returns to prescription creation  
24 screen 39 (Figure 3). Change Status button toggles the  
25 highlighted Act entry between "Y" and "N", and records a  
26 date and physician name with any status change. Add button

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2242

1 164 enables a physician user to add a new condition to the  
2 list, using condition selection pick lists, as previously  
3 described. This routine may be used to note problems for  
4 which there is no specific prescription given, e.g. obesity  
5 or senile dementia.

6

7 Where the inventive prescription management system is  
8 applied to statistical data collection for outcome studies,  
9 it is preferable to supplement the patient record with a  
10 range of relevant personnel data, to the extent that this is  
11 available, for example drug abuse behavior, smoking and  
12 habitual eating or drinking behavior, dietary habits,  
13 marital and family status, pregnancies, ethnicity,  
14 environmental factors, and so on. The system provides an  
15 excellent means for tracking these factors and their changes  
16 as they may pertain to an individual's health. For example,  
17 data fields could be added to record any of the foregoing  
18 data and the data could be updated by medical or  
19 administrative personnel in preparation for a patient-  
20 physician encounter.

21

22 Of particular significance to outcome studies will be death  
23 certificate information, and preferably this information is  
24 added to the patient problem record of Figure 13, as  
25 appropriate.

26

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1 More complex embodiments of the invention can integrate  
2 applications for prescription management with equivalent  
3 applications for diagnostic tests, laboratory analyses, and  
4 radiological studies to provide a more comprehensive patient  
5 history viewable in multiple screens. Of particular value  
6 in such an integrated presentation are laboratory results  
7 providing drug dosing levels, renal and liver function tests  
8 that provide important indications as to appropriate dosing,  
9 and so on.

10  
11 Figure 14 shows a manually maintainable problem record  
12 maintenance screen, for physician use, which can be accessed  
13 for example from the Doctor's lists button 24 in the system  
14 entry screen of Figure 1. This screen enables a doctor or  
15 physician manually to maintain their own personal customized  
16 prescription, diagnosis, allergy or other useful lists, to  
17 supplement the automatically maintained system lists. If  
18 desired, problems the doctor's patients have experienced  
19 previously can be system-added to the list, for example when  
20 a patient is selected. These personalized lists or profiles  
21 are posted to the network where the system can retrieve them  
22 to any user interface device via a host computer facility,  
23 subject to appropriate password protection or the like.  
24 Relying upon such centrally stored personalized profile  
25 files, the system can present a customized, personal  
26 appearance, with familiar configurations, attuned to the

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1 user's work habits, at any geographical location from which  
2 the network can be accessed.

3

4 The problem record maintenance screen of Figure 14 comprises  
5 a **Problem List** box 166, a **List Type** box 168 and a **Problems**  
6 box 170 displaying a comprehensive, or preferably exhaustive  
7 list of problems which can be selected and transferred to  
8 the network and the physician's problem list by pressing  
9 update button 172. Highlighted entries can be removed from  
10 the Problem List 166 by pressing delete button 174. Save  
11 button 176 and Exit button 178 perform the usual functions,  
12 and preferably provide options to cancel changes, and the  
13 like. Data entry box 180 permits an unlisted condition to  
14 be keyed in, or otherwise entered character-by-character and  
15 paging buttons 142 move between lists.

16

#### 17 Archiving

18 Given the medical, commercial and legal significance of the  
19 transactions executed and the data generated by use of the  
20 system of the invention described herein, as well as the  
21 value of that information to the patient, the physician and  
22 many other organizations, maintenance of accurate historical  
23 records, or archiving, is desirable, or essential, and  
24 preferred embodiments of the invention provide archiving at  
25 a host computer facility 106.

26

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1 Data storage burdens attendant upon long-term archiving are  
2 substantially relieved by using virtual patient records, as  
3 described herein. Pursuant to the principles relating to  
4 the use of virtual patient records dynamically created from  
5 source data record elements, the invention prefers to  
6 archive such data as will enable a full and accurate record  
7 of the past to be regenerated from diverse sources, rather  
8 than recording the past verbatim. Date and time stamped  
9 record elements allow recreation of a virtual patient record  
10 at any point in time.

11  
12 Preferably, the data logged into archives comprise all data  
13 relevant to a patient's diagnosis and therapies, data  
14 relevant to the user's prescribing activities, including the  
15 prescriber's relevant electronic communications ("e-mail")  
16 with third parties (pharmacies, laboratories, other health  
17 care providers, or potential providers, to the patient, and  
18 so on) and access audit data as to parties accessing the  
19 patient's or prescriber's personal data.

#### 20 21 System-support infrastructure

22 Referring to Figure 16, the lefthand side of the diagram  
23 shows an arrangement of services and devices that provide a  
24 downstream flow of data and communications resources to  
25 users of the prescription management, or other system  
26 described herein. The righthand side shows sources from

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1 which desired data and data elements may be drawn and  
2 pathways for those data to reach the user, the flow being  
3 marshalled by a centrally depicted host computer.

4  
5 Shown schematically in Figure 16, are a number of user  
6 interface devices 200 and a desktop computer 201  
7 communicating via any of a variety of communication services  
8 202, through a gateway-router 204 with a host computer  
9 facility 206. The drawing depicts schematically how a group  
10 or pool of users working with interface devices 200 or  
11 computers 201, running the prescription management software  
12 of this invention, can be serviced by host computer facility  
13 206. Those skilled in the art will appreciate that the  
14 schematic layout shown in Figure 16 is described in terms of  
15 its logical architecture and that the actual physical  
16 disposition of elements may be quite different.

17  
18 In addition to coordinating system-related communications,  
19 especially retrieval of source data from remote databases,  
20 gateway-router 204 can manage supplementary services such  
21 for example as a paging service 208 or any other relevant  
22 desired function.

23  
24 Interface devices 200 are depicted as small form factor,  
25 handheld devices, or PDA's, communicating wirelessly over a  
26 WAN, a proprietary wireless service, or a cellular digital

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1 packet data service, or the like. Desktop computer 201,  
2 which may be a portable, notebook or other higher form  
3 factor computer, connected to communications gateway-router  
4 204 via a local area network labeled LAN<sub>1</sub>, which connection  
5 could equally well be via modem, infra-red, wireless or the  
6 like, depending upon the circumstances. Any suitable  
7 network may be used, depending upon the user's equipment and  
8 the location of desired resources. Wired or wireless, local  
9 or wide area networks, or mixed networks, are suitable.

10  
11 Routing to the appropriate service and other communications  
12 technicalities are coordinated by communications gateway-  
13 router 204 which is networked or otherwise connected with  
14 host computer facility 206.

15  
16 Other prescribers (or other professionals in different  
17 environments) may use different methods to communicate with  
18 host computer facility 206 using a two-way digital data  
19 communication system across a network.

20  
21 Still other users may be supported by other host computer  
22 facilities communicating in their turn with host computer  
23 facility 206 using appropriate network services and  
24 providing communication links or pathways between such other  
25 users and physician users supported by host computer  
26 facility 206. Such organizations employing one or more

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1 each of both users and host computer facilities are intended  
2 by references herein to "network" or the "network".  
3

4 Communication services 202 can be any service providing  
5 effective two-way data transfer between users 200 and host  
6 computer facility 206. As labeled, some possible  
7 communication services 202 are wired local area networks  
8 "LAN<sub>1</sub>...LAN<sub>n</sub>", wireless local area networks "WLAN<sub>1</sub>...WLAN<sub>n</sub>"  
9 and proprietary radio frequency packet data networks, such  
10 as ARDIS and RAM (trademarks of their respective  
11 proprietors), cellular digital packet data networks  
12 "CDPD<sub>1</sub>...CDPD<sub>n</sub>" and so on.  
13

14 Not shown is a wire telephone connection between a user  
15 device 200 and communications gateway-router 204. This is  
16 of course a possible embodiment of the invention and it is  
17 also, to be understood, local area networks LAN<sub>n</sub>, could  
18 comprise a single desktop computer or a facility-based  
19 networked system of multiple desktop, or other computers.  
20

21 Communications gateway-router 204 manages communications  
22 through these various media services and provides consistent  
23 interfaces to users at devices 200 and to host computer  
24 facility 206, regardless of which communication service 202  
25 is used.  
26

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1 As referenced hereinabove, host computer facility 206 can  
2 comprise a client-server system in which a file server or  
3 database management server, or cluster of such servers,  
4 manage data storage and traffic functions, providing high  
5 volume data availability to multiple intelligent clients  
6 linked, typically over a local area network, to the server  
7 or servers.

8  
9 Exchanging data, programs and processing services across  
10 this system, user interface devices 200 and host computer  
11 facility 206 support applications such as the prescription  
12 management system of the invention, E-Mail services and any  
13 other desired applications, for example patient encounter  
14 management programs, diagnostic procedure management  
15 programs, and the like, in an analogous manner to  
16 conventional client-server supported operation of such  
17 applications.

18  
19 Host computer facility 206 provides intelligent network  
20 services to user devices 200 and 201 and may support  
21 ancillary services, especially for example, as described  
22 hereinbefore, patient-directed data access control software.  
23 Prescriber-directed data access control software or  
24 organization-directed data access control software could  
25 also run in an application separated from the prescription  
26 management system, but is preferably integrated therewith as

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1 a component of a user initialization routine.

2

3 Conveniently, patient interface components of the patient-  
4 directed data access control software are run at separate  
5 stations from the point-of-care locations used by  
6 prescribers and are located, for example, in administrative  
7 or reception areas of health care facilities or managed care  
8 organizations. Here, data access rights may be read off a  
9 patient's data access control card, and such cards may be  
10 issued, under control of software supplied by, and in  
11 communication with host computer facility 206.

12

13 The level of software and data resident on interfaces  
14 devices 200 can be varied according to their physical  
15 capabilities and user or system administrator preferences.  
16 At a minimum, and for device redundancy, interface devices  
17 200 need have resident neither files nor software, beyond  
18 what is supplied with the device off the shelf.

19

20 So long as the user interface device has an operating system  
21 and is communications-equipped, they may establish  
22 communication with host computer facility 206, using a  
23 separately supplied electronic address for that facility and  
24 may upload necessary program components and data files,  
25 including such personalized user profiles as have been  
26 established by the user's prior experience with the system

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1 and which have been stored at the host computer facility  
2 206, are called from a remote host computer facility  
3 supporting other users.  
4

5 Neither such program components, nor data, need be stored on  
6 the interface device 200 but, where the device 200 has  
7 adequate storage capacity, it will be more convenient and  
8 faster-loading for a user to maintain configuration and user  
9 profile files, along with limited amounts of relevant drug,  
10 and possibly patient data, on the user's local interface  
11 device 200. Preferably, however basic system access  
12 software is required to be installed on the user device  
13 before system resources can be accessed. Such basic system  
14 access software can be activatable after reported loss or  
15 theft to disable system access capabilities and to render  
16 any stored proprietary data inaccessible to unauthorized  
17 users.  
18

19 Host computer facility

20 Host computer facility 206 provides full software support  
21 for user interface devices 200 and maintains complete  
22 program files for the prescription management system along  
23 with e-mail services and any other non-personal applications  
24 that may be needed by users of devices 200 beyond the basic  
25 operating systems and utilities, and the like, with which  
26 the devices are originally equipped.

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1 Host computer facility 206 maintains databases of patient  
2 information for patients encountered or whose records have  
3 previously been viewed by users of devices 200 in response  
4 to calls sent via host computer facility 206, (and logged by  
5 it for audit purposes) but, in keeping with the preferred  
6 practice of the present invention, host computer facility  
7 206 does not maintain patient records in permanent storage.  
8 It could however be used to maintain patient record  
9 components that are source components to users of devices  
10 200 for which this particular host facility 206 is, at it  
11 were, their "home" facility.

12  
13 Important functions maintained by the host computer facility  
14 206 are information locator databases and advanced directory  
15 and routing services, including the following:

- 16 i) a user device and system registry enabling  
17 communications to be routed to the target user;
- 18 ii) a patient information directory service enabling  
19 access the system to access remote databases to  
20 retrieve patient record components for compilation  
21 of virtual patient records as described above;
- 22 iii) archiving of transaction logs and records, and of  
23 audit logs;
- 24 iv) patient drug formularies and formulary guidelines  
25 or locators to access same;
- 26 v) libraries of alerts and other system displayed

1           messages; and

2           vi) access control software and related data files for  
3           patients, care providers and organizations.  
4

5   Drug and condition lists and some drug information are also  
6   maintained on the host computer facility 206, but these are  
7   preferably either synchronized or refreshed at intervals  
8   (e.g. overnight) from source databases of such drug  
9   information. More detailed drug information (e.g. U.S.  
10   Pharmacopeia information) can be retrieved from remote  
11   databases by host computer facility 206. Host computer  
12   facility 206 also maintains directory services for accessing  
13   such drug related information, formularies, guidelines alert  
14   messages and the like and updates this data remotely from  
15   source databases maintained by the proprietors of the  
16   information.  
17

18   Also in addition, host computer facility 206 can off-load  
19   data-processing functions from interface devices 200, or  
20   conduct such functions in background to provide support for  
21   the relatively limited processing capabilities of devices  
22   200.  
23

24   A further important function of host computer facility 206  
25   is to retrieve multiple elements of a single patient record  
26   from multiple heterogenous remote databases and to deliver

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1 them to users for assembly into a virtual patient record by  
2 an interface device 200 or 201, in response to the user's  
3 call for that record.

4  
5 Host facility 206 can reach out nationally, or  
6 internationally, for example across the INTERNET (trademark)  
7 to multiple remote databases such as remote databases 210  
8 shown on the right hand side of Figure 16, to provide to  
9 users of interface devices 200 data resources beyond (and  
10 potentially more current than) those available from direct  
11 storage in the device or at the host facility.

12  
13 Communications

14 Communication between host computer facility 206 and remote  
15 databases 210 will usually be via wire lines such as  
16 telephone, or local or wide area network communication via  
17 copper line, or optical fiber, or any other suitable  
18 communication medium. Clearly, host computer facility 206  
19 can access any remote third party database with which  
20 appropriate arrangements have been made, or can be made on  
21 line, and some possible source databases for patient records  
22 components are labeled as ~~"HMO's, Hospitals Insurance, Drug~~  
23 ~~Benefit Cos, Pharmacies, Labs and Independent Physicians"~~.  
24 Drug information may be additionally sourced from  
25 pharmaceutical companies' research centers, reference  
26 libraries, or publishers and the like.

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5.C6

1 One or more pools of users of devices 200 and computers 201  
2 constitute a valuable professional audience and the system  
3 provides a valuable means enabling such third party database  
4 proprietors to become data publishers and electronically  
5 publish or post their databases or on the network to reach  
6 that audience.

7

8 Using recognizable common record element identifiers, for  
9 example patient identification numbers or drug identifiers,  
10 host computer facility 206 forages across available networks  
11 for similarly identified record elements to retrieve.

12 Employing its information directory services as locators,  
13 host computer facility can retrieve a variety of data  
14 including patient-specific data, application-specific data  
15 (users preferences and the like), organization-specific data  
16 (formulary guidelines, for example) and general drug or  
17 prescribing data, e.g. from MEDLINE.

18

19 To assist with compatibility problems with the legacy  
20 systems operating at remote databases 210 and to avoid heavy  
21 volumes of user calls, via the systems of the present  
22 invention, interfering with or slowing down the daily  
23 operations at the proprietary facilities supporting the  
24 remote data bases 210, this embodiment of the invention  
25 provides, at each of a limited number of remote databases  
26 210 known to be a significant source of patient record

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6

16

24

25 Integrating network 214 and API's 216 and 218 permit easy  
26 system integration, allow third parties to develop end-to-

1 end communications solutions with standardized third party  
2 communication across the network and a data "firewall" for  
3 security.

4

5 Data Warehouses 212

6 Each data warehouse 212 maintains replicated copies of  
7 relevant data sets obtained by read-only access of remote  
8 databases 210, which data sets are maintained synchronously  
9 with updated source data at remote databases 210, or are  
10 periodically refreshed therefrom, preferably at frequent  
11 intervals. Data warehouses 212 can also provide search and  
12 retrieval facilities and, in particular, provide protocol  
13 interchange and reformatting capabilities to reformat or  
14 otherwise standardize data and communications across network  
15 214, for any application to use. Preferably, to facilitate  
16 compliance with the desired auditability of the transactions  
17 and data accesses of preferred embodiments of the invention,  
18 data warehouses 212 screen data incoming from associated  
19 data warehouses 210 for date-stamping, and preferably, also  
20 time-stamping, of individual received data or record  
21 elements, and reject those that lack such stamps.

22 Preferably also, the date stamp indicates origination,  
23 creation or updating of the data element, rather than being  
24 merely a date of entry of the data element into data  
25 warehouse 212.

26

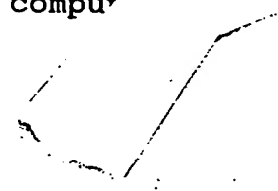
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1 Source data generated by point-of-care or other transactions  
2 at user interface devices 200 or computers 201, can be  
3 directly posted to remote databases 210 across network 214  
4 which bears two-way traffic. As will be apparent from the  
5 disclosure herein, remote databases also include data from  
6 other places, for example pharmacies, laboratories and  
7 testing facilities.

8  
9 Communications gateway-router 204 also maintains a  
10 physician-device directory providing routing or access  
11 information needed to establish communication protocols with  
12 each individual physician. This device directory service  
13 can maintain an electronic address, a device identifier or  
14 device configuration, operating system information and user  
15 device communications protocols for each user device  
16 supported by the gateway-router. User ID's can be listed  
17 separately and in preferred embodiments are accompanied by a  
18 prioritized listing of one or more device addresses where  
19 the user may be accessed.

20  
21 Other temporary or permanent update means are provided to  
22 enable a user to access the host computer facility from more  
23 than one device, preferably using an address that is device-  
24 independent.

25  
26 It will be understood that an individual host compu



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## 20

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a  
1 are known to be effective, and emphasis has been placed  
2 herein on a drug selection and specification which begins  
3 with selection of a problem or condition to be treated,  
4 because this is <sup>to be</sup> an appealing and beneficial approach in  
5 many circumstances. Frequently however, the physician may  
6 know exactly what drug they wish to prescribe, in which case  
7 they can proceed to a direct drug entry screen, and then  
8 <sup>on</sup> ~~specify~~ the condition targeted by the prescribed treatment.  
9

10 While emphasis has also been placed in the principle  
11 examples on the prescription of drugs, it will be  
12 appreciated that the invention can be beneficially applied  
13 to the specification of other therapies and technical  
14 remedies for example to the specification of surgical  
15 procedures, physical therapies and diagnostic testing.  
16

17 Preferred embodiments of the invention include quick and  
18 easy routines for directly posting a drug to a prescription,  
19 without prior condition selection, such routines preferably  
20 being by-passed. In order to gain the subsequent  
21 historical review and outcome study benefits described  
22 herein, it is preferred to provide for inclusion of a  
23 treatment objective of the prescribed drug in the  
24 prescription record before completion of the prescription.  
25 The treatment objective can be rapidly selected from a  
26 system-supplied list of a patient's existing or historical

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1 conditions, or through powerful system-aided selection of a  
2 new condition. While a default patient condition or  
3 problem may be suggested by the system for a particular  
4 prescribed drug, it is preferred that such default be  
5 actively confirmed by the prescribing user before being  
6 accepted by the system.

7

8 To accommodate direct prescribing by drug name, Drug field  
9 88 of the prescription creation screen of Figure 3, can open  
10 a personalized or customized user-activatable drug list, or  
11 proceed to comprehensive system drug lists to enable rapid  
12 specification of familiar or unfamiliar drugs prior to  
13 condition selection. Drug dosage selection then proceeds as  
14 described above. Before leaving prescribing zone 44 of the  
15 prescription creation screen 39 the system can require an  
16 appropriate entry to be made in Condition field 86.

17

18 Other preferred embodiments enable the patient, the  
19 prescribing physician and the relevant organization to  
20 control the flow of their own data by predetermining access  
21 rights to that data. Every transaction can be stamped with  
22 a patient identifier, a prescriber identifier and, if  
23 appropriate, an organization identifier, as well as with the  
24 date and time of day.

25

26 Emphasis on preferred, historical or customized short lists

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1 of drugs and conditions enables an attractive working  
2 environment to be provided even on relatively low power  
3 PDA's. Short list data may be maintained on the user device  
4 providing rapid responses in the user's most common  
5 prescribing situations. Less common situations entail calls  
6 to the host computer facility, in which circumstances delays  
7 of a few seconds while data is retrieved from the network  
8 are quite acceptable.

9  
10 System requirements

11 User software components of a currently preferred embodiment  
12 of prescription management system described herein are  
13 designed to run under an operating system that preferably  
14 supports a full or modified version of MS-DOS® (trademark,  
15 Microsoft Corporation) WINDOWS™ (Microsoft Corporation) or  
16 other systems with user-friendly graphical interfaces, for  
17 example Apple Computer Co.'s MACINTOSH (trademark) or NEWTON  
18 (trademark) operating systems and General Magic's MAGIC CAP  
19 operating system. Other graphical environments can be used  
20 or are being developed and other embodiments of the  
21 invention may be suitably modified to optimize the  
22 application to take advantage of the unique characteristics  
23 of each such operating system environment.

24  
25 The programming language used to write system software  
26 depends upon the environment of the various system

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1 components. In their present stage of development, some  
2 handheld PDA's require applications to be written with the  
3 tools provided by their respective operating systems such as  
4 NEWTON or MAGIC CAP (trademarks). For other devices such as  
5 those supporting Microsoft's WINDOWS (trademark) operating  
6 system, including some PDA's, a range of languages can be  
7 used including for example, popular programming languages  
8 such as Microsoft Corporation's "C" or Borland  
9 International's "C++". For Apple Computer's MACINTOSH  
10 (TRADEMARK)-based systems, languages such as THINK  
11 (TRADEMARK) are appropriate.

12  
13 The system is particularly advantageous when implemented on  
14 any of a variety of portable computer stations especially  
15 handheld units such as personal digital assistants and other  
16 personal information communicators equipped with wireless  
17 communicators. A preferred embodiment for mobile  
18 professionals comprises such a handheld unit with two-way  
19 radio or infrared communication facilities. Some such  
20 devices are referenced in a "BUYER'S GUIDE: PERSONAL DIGITAL  
21 ASSISTANTS" PC WEEK August 29, 1994, pages 89 and 94 the  
22 disclosure of which is hereby incorporated herein by  
23 reference thereto.

24  
25 For compatibility with the currently rather limited  
26 performance specifications of such desirable handheld

1 devices the prescription management system of the invention  
2 is preferably designed to minimize the storage and  
3 processing requirements placed on the user's terminal and to  
4 off-load storage and processing to host computer facilities.  
5 Thus, the system's support architecture aims to supply to  
6 the user terminal only essential data required for screen  
7 displays and other user functions, on an as-needed basis,  
8 while the network stores applications and data files, for  
9 example at the host computer facility.

10  
11 Modified Embodiments of the Invention

12 While the invention has been described with a reference to a  
13 particularly valuable embodiment of a prescription  
14 management system, it will be understood by those skilled in  
15 the art that alternative embodiments of the invention can  
16 bring valuable benefits in their respective fields where  
17 informed choice is desirable and can be facilitated by  
18 interactive computer-assisted decision-making, especially in  
19 situations where decision-relevant data is or can be drawn  
20 from multiple heterogenous remote databases.

21  
22 Some such possible applications of the invention are to the  
23 specification of laboratory tests and also in the veterinary  
24 field, and to non-pharmaceutical environments where benefits  
25 such as valuable historical records and follow-up studies,  
26 as well as quality control improvements, can be obtained

1 from coupling diagnostic conclusions with specified problem  
2 solutions.

3

4 Thus, according to one such a modified embodiment of the  
5 invention, laboratory test information can be presented to a  
6 prescribing professional by first listing patient conditions  
7 which the professional wishes to explore more fully by  
8 specifying one or more specific laboratory tests, by  
9 reporting the laboratory result and suggesting further  
10 testing for differential diagnostics. The system then  
11 provides a selection of laboratory tests known to be useful  
12 in evaluating the relevant condition, that selection and  
13 organization of laboratory tests being made in a manner  
14 similar to that described for therapeutic drugs in the  
15 preferred embodiments herein, and moves on to create, select  
16 and order appropriate cost-controllable diagnostic testing,  
17 in a comparable manner to that described herein for creating  
18 a prescription.

19

20 For example, an analogous diagnostic application may provide  
21 cost-effective routes to rule in or rule out specific  
22 diagnoses. The specificity and sensitivity of individual  
23 procedures can be translated into positive predictive values  
24 and negative predictive values. By applying decision theory  
25 and analyzing probable outcomes of procedures or  
26 combinations of procedures in the light of the patient's

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1 bio-characteristics and known conditions, diagnostic  
2 protocols can be worked up and maintained with current  
3 recommendations. Evaluation of the patient's history can  
4 enable pretest probabilities to be established and used to  
5 modulate the predictive value of one or more tests. Thus  
6 the patient's history can drive the selection and  
7 establishment of an optimal diagnostic test matrix for  
8 identifying a patient's condition or conditions with good  
9 specificity and confidence levels.

10  
11 Test requirements relating to patient preparations, fasting  
12 for example, and sample collection can be system specified.  
13 By generating system-maintained identifiers (e.g. bar code  
14 labels) for attachment to samples at the point-of-care, a  
15 chain of evidence for rigorous sample accessioning can be  
16 begun.

17  
18 Thus, a range of possible conditions can be evaluated in a  
19 differential diagnosis format designed to rule in or rule  
20 out a target condition, or conditions, depending upon the  
21 results of specified tests.

22  
23 Extensions into the veterinary field will be apparent to  
24 those skilled in the art in that instead of the physician  
25 user referenced herein, reference to a veterinarian is  
26 appropriate, and the patient will be an animal such as a pet

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1 dog or cat or valuable livestock, such as a steer or  
2 breeding pig or a race horse or breeding stallion.

3

4 Again, although the invention has been described in its  
5 preferred embodiments with reference to a physician user it  
6 will be apparent that other medical professionals,  
7 especially those having prescribing authority, can benefit  
8 from applications of it.

9

10 In a more general sense, the invention provides a service  
11 professional with significant new benefits, especially  
12 during a service encounter with a customer or client, in  
13 selecting, specifying or providing technical remedies to  
14 consumer problems. For example, in specifying automotive  
15 replacement parts a service technician can benefit from an  
16 automotive service management system according to the  
17 invention in which a database of replacement parts is  
18 classified according to the service problem for which the  
19 parts might provide a remedy. Thus, for a customer with the  
20 problem of brake squeal, the system may provide a list of  
21 parts, for example, brake pads, brake pins, brake shims or  
22 brake rotors, any of which may provide a remedy to the  
23 customers problem of brake squeal. Existing systems permit  
24 a service technician, having once identified the type of  
25 part they need, to obtain a number or part price and  
26 inventory on that part for the customer's specific model of

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1 car.

2

3 However, known systems do not permit the professional to  
4 query the system by customer problems, nor do they provide a  
5 summary of all facets of a solution to a problem leading to  
6 a summarized cost of treatment. In addition the inventive  
7 system can provide access to technical literature on  
8 relevant problems, for example an explanation of the factors  
9 causing brake squeal which can be printed out for customers.

10 This is a rather simple example. More complex examples will  
11 be apparent to those skilled in the automotive and other  
12 arts, especially as this art develops, with sophisticated  
13 engine management and other microprocessor controlled  
14 systems raising new problems and new technical solutions  
15 being required. The inventive system can provide customer  
16 problem lists useful for outcome analysis to drive the  
17 development of better cars.

18

19 Of great value in the automotive and allied fields, equating  
20 a parts supplier, such as a factory or warehouse distributor  
21 with a plan benefit company is the ability to provide new  
22 product descriptive and price information or updates from  
23 multiple sources dynamically, in real time as transactions  
24 are created. Noting the desire of a benefits company to  
25 apply practical selection guidelines in an unobtrusive  
26 manner to the prescribing process, an equivalent technique

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1 can be used by car factories to help control warranty  
2 service decisions at their dealerships.

3  
4 In another embodiment of the invention illustrating its  
5 generality, possible insurance vendors and coverage  
6 information may be classified according to customer problems  
7 so that, for example, an insurance agent may list different  
8 vendors and coverage providing specific technical remedies  
9 to a customers specific; problem, for example, a recent  
10 major automobile collision claim. The relevant novel  
11 supportive database could include information  
12 differentiating between parties at fault, collision damage,  
13 personal injury settlements and so on. In both these  
14 examples a problem history related either to the customer or  
15 to the customer's automobile can also be created.

16  
17 It will be clear to those skilled in the art that use of the  
18 prescription management system described herein, employing  
19 carefully maintained databases of accurate, reliable  
20 prescribing data will produce high quality prescriptions  
21 free of many of the problems now plaguing prescription drug  
22 use. With confidence that a physician is prescribing  
23 appropriate, cost-effective drugs selected from user-  
24 personalized lists which link to comprehensive condition and  
25 drug lists including the latest available drugs, and that  
26 the prescribed drug has been reviewed for contraindications,

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1 patients benefit, oversight of the prescribing process by  
2 benefit companies and regulatory bodies can be reduced, and  
3 litigation resulting from prescribing errors will be  
4 reduced. Significant improvements in the quality of care,  
5 substantial savings and the elimination of waste can accrue  
6 to a national or regional health care system from widespread  
7 deployment of the inventive prescription management system  
8 described herein.

9  
10 Physical embodiment of system software

11 The foregoing specification, read with the accompanying  
12 drawings provides an extensive disclosure of, inter alia,  
13 various embodiments of systems and software facilitating  
14 professionals to select or specify technical products to  
15 solve practical problems, and also to create, or assist the  
16 professional to create, new products which will assist the  
17 professional or their client in achieving desired problem-  
18 solving goals.

19  
20 It will be understood that the systems and software  
21 referenced herein include, either explicitly, or implicitly,  
22 software implemented on computers or other appropriate  
23 hardware, including user devices such as the personal  
24 digital assistants described herein, and such other  
25 intelligent data processing devices having a processor, data  
26 storage means and the ability to support an operating

1 system, with or without user interfaces (for example, file  
2 servers,), as may be useful in achieving the objectives of  
3 this invention.

4  
5 Software components and applications embodying the invention  
6 can be distributed in electronic bit storage on magnetic,  
7 optical, bubble or other media, optionally in transportable  
8 form to be interactive with an electronic reading device,  
9 for example on computer or optical diskettes, or may be  
10 distributed over wired or wireless networks for storage by  
11 the recipient on such media.

12  
13 Preferred embodiments of the invention provide such media-  
14 stored software in a commercial package accompanied by  
15 instructions in printed book or booklet form, for deployment  
16 of the software on particular embodiments of general purpose  
17 computer to cause same to operate as a special purpose  
18 computer, in accordance with the objectives of the  
19 invention. License agreements, and registration means for  
20 updating may also be included. Alternatively, the  
21 instructions may also be provided as data files.

22  
23 It will further be appreciated that such media-stored  
24 software constitutes an electronic customizing machine which  
25 can interact with a magnetically or optically cooperative  
26 computer-based input device enabling the computer to be

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1 customized as a special purpose computer, according to the  
2 contents of the software. To cause a computer to operate in  
3 such customized, special-purpose mode, the software of the  
4 invention can be installed by a user, or other, and will  
5 usually interact efficiently with the device on which it is  
6 resident to provide the desire special-purpose qualities,  
7 only after selection of configuration parameters. When so  
8 configured, the special-purpose computer device has enhanced  
9 value, especially to the professional users for whom it is  
10 intended.

12 While some illustrative embodiments of the invention have  
13 been described above, it is, of course, understood that  
14 various modifications will be apparent to those of ordinary  
15 skill in the art. Such modifications are within the spirit  
16 and scope of the invention, which is limited and defined  
17 only by the appended claims.

19 Thus, while certain aspects of the invention have been  
20 disclosed as embodied in connection with a prescription  
21 management system, it will be apparent that they have  
22 broader application in other systems or environments. Some  
23 of these aspects are: dynamic assembly of records from  
24 source record elements retrieved across a network from  
25 heterogenous remote databases; requirements for those  
26 elements to be time- and date-stamped for retrospective

1 recreation of records from archival logs; physician-centric  
2 drug formularies; data-access control systems and software;  
3 the novel directory services described herein and associated  
4 online point-to-point e-mail and data retrieval systems;  
5 data retrieval networks with API-enabled end-to-end  
6 transparency; novel outcome studies, monitoring and alerting  
7 procedures, studies and related products; novel scheduled  
8 dosage drug packs and dispensing devices, and so on.

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